162-12.

Tile

NATCO

WALL CONSTRUCTION

BULLETIN No. 174

follow tile

A.I.A. File Number 10a11
Block Construction

A.I.A. File Number 3h
Masonry Materials

NATCO
WALL CONSTRUCTION

BULLETIN No. 174

THIS volume, treating on the various types of NATCO Hollow Tile for exterior and interior walls of all kinds, is a complete text book for the guidance of architects and builders. The methods illustrated and described represent the work as approved by fireproofing engineers and architects, having been determined by wide practical experience in NATCO Hollow Tile construction.

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GENERAL OFFICES
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Flatiron Building	Land Title Building	Textile Building	26th and Shields Avenue

NATIONAL FIRE PROOFING COMPANY OF CANADA, LTD.
TORONTO, ONTARIO

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Introduction

NATCO XXX hollow tile with its superior qualities of extra heavy shells and webs, all in direct alignment when laid, and deep dovetail scoring, which affords the best possible mechanical bond for the stucco, costs but little more than other types of tile.

NATCO DOUBLE SHELL TILE, an improved face-tile with double shells for the spreading of horizontal or bed joints of mortar and a moisture stop at each end, not only affords the advantages of end construction (setting the tile with enclosed air-spaces vertical in the walls as embodied in NATCO XXX construction referred to above), but also prevents the spreading of "through" mortar joints, either horizontal or vertical, and thus insulates the wall efficiently against passage of moisture, heat, frost, and sound.

NATCO Header Backer tile, as used for backing up brick walls in buildings of skeleton construction and in loadbearing walls, is flexible and meets every brick and mortar joint condition. Through its use you save ¼ of the dead load, labor and mortar. Savings in structural steel run into tons and foundation costs are materially reduced.

NATCO SMOOTH TILE is a less expensive face tile for non-bearing or curtain walls of factories, railroad warehouses, farm buildings, etc.

Bulletin 171, on NATCO Standard Fireproofing, describes very completely the use of NATCO Hollow Tile for floors, girder covering, column covering and similar construction. A copy of this bulletin will be sent to you on request.

We shall be glad at all times to give additional or special information regarding our products and their different uses in building construction to any interested party.

Specifications for Erecting Natco XXX Hollow Tile

GENERAL:—Provide and erect all hollow tile exterior and interior bearing walls of hard burned tile, true and regular in size, manufactured of such design that all webs and shells are in direct compression when laid in the wall. Tile shall have all faces scored with special dovetail scoring to offer a good surface for the stucco finish. Tile cracked or broken on the outside shells will not be acceptable under this specification.

All subdividing, non-bearing partitions shall be of hollow partition tile as shown on plans. In general all exterior walls and interior bearing walls shall be of NATCO XXX hollow tile; subdividing walls shall be NATCO partition tile as manufactured by the National Fire Proofing Company.

LAYING:—All tile used in the exterior walls and interior bearing partitions must be laid with the holes or voids vertical in the wall, in order to develop their full strength. (See Page 7.) No vertical or head joints shall be mortared through the walls, but a generous air-space shall be left in the center of the walls by buttering the two edges of each tile either before or after it is set in the wall. Interior subdividing, non-bearing partition tile may be laid on side if desired. Care must be taken that the top of all unfinished walls are thoroughly covered or protected against stormy weather.

MORTAR:—All mortar used for laying up the hollow tile shall consist of a standard Portland cement and clean sharp sand in the proportion of one part cement to three parts sand, well mixed to a smooth, moderately stiff mortar. Lime not to exceed 10 per cent. of the cement by volume, will be allowed in the mortar.

FOUNDATION WALLS:—Where so indicated on plans, the foundation walls from top of footings to the underside of first floor beams shall be constructed of 9-hole 12 x 12 x 12 NATCO XXX hollow tile. Care should be taken to use 6 x 12 x 12 NATCO XXX hollow tile at the corners. (See Page 7.) Outside of walls from footing to a point above the ground shall be given a heavy coat of waterproofed cement or other approved damp-proofing.

Where columns or piers supporting heavy loads rest on the foundation wall, the same shall be filled with concrete from footing to top of wall to prevent the possibility of failure due to compression.

EXTERIOR WALLS AND BEARING PARTITIONS:—Exterior walls and bearing partitions shall be of thickness shown on the plans and must be in accordance with the foregoing conditions of quality, etc.

SUBDIVIDING PARTITIONS:—Subdividing, non- bearing partitions shall be of hard burned NATCO hollow tile (scored for plastering). All partitions must be started on the structural floor and wedged against the floor above.

JAMB TILE:—Provide for all double hung windows, NATCO XXX jamb tile with rabbetted openings to receive the window frame box. Fill well with mortar the space between the tile and the frame box to within one inch of stop bead with roofer's cement or oakum to prevent the passage of air or moisture. (See Page 9.)

LINTELS:—Openings not exceeding 5′ 0″ in clear span may be spanned with NATCO XXX arch lintel tile or with NATCO XXX tile reinforced with rods in lower cells and filled solidly with concrete. (See Page 15.)

Openings over 5′ 0″ in clear span to be spanned with reinforced concrete girder faced with tile, or with steel angles—size of structural or reinforcing steel variable with load and span.

SILLS:—Form all sills of NATCO special hollow sill tile. Special care must be taken to fill all joints so as to prevent moisture working through the same; wood sill of frame to be set in a heavy bed of roofer's cement. (See Page 9.)

ARCH OPENINGS:—Build all arch openings shown on plans of two course rowlock hollow brick header arches, carefully laid on substantial centers, or of hollow tile units small enough to get proper camber without top mortar joints being too heavy. (See Page 13.) Arches will spring from the hollow tile and must be well bedded on them.

PORCH COLUMNS AND PIERS:—Construct the porch columns and piers of hollow tile to sizes as shown. Where column finish is round, build the same of three-inch circular hollow tile column covering, filling the column with concrete whenever deemed necessary. Square columns shall be built of the proper size NATCO XXX tile. If steel reinforcement is used, care should be taken to band the steel against lateral deflection. (See Page 12.)

FLOOR BEAM BEARINGS:—Provide and set tile slabs one inch thick under all floor beams as bearing plates for the same. (See Page 18.) These slabs shall also be used for working up to levels and story heights when the full or fractional tile do not work out correctly.

BEAM COURSES:—Wood floor beams are to be framed into exterior walls as shown on detail, using NATCO XXX hollow tile in accordance with the following: in eight-inch walls 3¾ x 12 x 12 for facing ends of beams, and 3¾ x 12 x 12 for filling between beams. (See Page 18.) In ten-inch walls 3¾x12x12 for facing ends of beams and 6x12x12 for filling between beams. In twelve-inch walls 3¾x12x12 for facing ends of beams, and 8x12x12 tile for filling between beams.

ROOF PLATES:—Embed in cement grout in two upper courses of wall at intervals of five feet, ¾-inch bolts twenty-four inches long. Bolt to project six inches above the top of the wall to allow of plate being fastened down with nuts. (See Pages 18 and 19.)

Specifications for Stucco on Hollow Tile

All joints between door frames, window frames at head, sides and sills, must be tightly calked with oakum or roofer's cement; also the wash or slope of sills, etc., should be given a heavy coat of waterproofing before stucco is applied.

All stucco should be applied immediately upon being mixed and should not be retempered after it has become partially set. No stucco is to be applied in freezing weather or when it is liable to freeze before it sets. It is advisable to keep all stucco work thoroughly wetted down until cement has set, particularly in hot weather as too rapid drying will cause cracking.

The surface to which scratch coat is applied shall be free from all foreign material and shall be thoroughly wetted down before the first coat is applied. The first coat to be applied with force so as to key behind the dovetail scoring, also to prevent air bubbles or holes, and to be thoroughly scratched to insure proper bond with the next coat. The second coat should be applied as soon as the prior coat has sufficiently set to allow working upon the same, and should be straightened with darby and straight edge, then floated with cork or wooden float to prevent waves showing on the finished wall.

Should it be impossible to apply the second and latter coats as soon as the former coat has become thoroughly set, it is advisable to wet down the coat which has been applied as this gives a better bond between successive layers.

The finish coat should, as far as possible, be applied to the entire area of one side of structure at one operation. No finish coat should be left in an unfinished condition. All work should be covered to corners.

Thickness of each coat should average from one-quarter to one-half of an inch. While two coats of stucco, carefully applied, having a total thickness of not less than three-quarters of an inch is allowable for rough cast or pebble dash finish, much better results can be obtained when three coats are applied. Three coats should always be applied when a smooth or float finish is desired.

Finish coat of stucco should be waterproofed with an approved brand of Integral Waterproofing Compound or other approved compound as per directions of manufacturers.

Materials

The materials composing the stucco shall consist of:—

1. Portland cement which has been carefully tested and found to meet the requirements of the American Society for Testing Materials.

2. Sand which is free from organic matter or loam and uniformly graded in size from coarse to fine.

3. Hydrated lime—any good brand of prepared hydrated lime or well burned slacked lime putty will be accepted.

Proportions

FIRST COAT:—1 cement
1/10 lime
2 sand

SECOND COAT:—1 cement
1/10 lime
2½ sand

THIRD COAT:—1 cement
1/10 lime
3 sand

Comparison of Tile Sizes with Brick

Allowing for the joints in brick work, the several sizes of NATCO hollow tile are equivalent to the following number of brick, based on the standard size common brick as adopted in February, 1920, which is 8″ x 2¼″ x 3¾″.

⅜″ thick joints are allowed for in connection with brick.

4 x 12 x 12 NATCO tile is equal to 7 bricks
8 x 12 x 12 NATCO tile is equal to 14 bricks
12 x 12 x 12 NATCO tile is equal to 21 bricks
4 x 5 x 12 NATCO tile is equal to 3 bricks
8 x 5 x 12 NATCO tile is equal to 6 bricks

Cement Mortar

NATCO Hollow Building Tile should be set with cement mortar composed by measure of one part Portland cement to not more than three parts clean sharp sand, to which may be added hydrated lime not exceeding 15% by volume of the cement.

NOTE—The percentage of lime added is always figured on the quantity of the cement used, therefore 15 per cent is equal to about one-sixth part by measure of the cement.

The lime specified is not needed to make the mortar stronger, but to make it more plastic and easier to handle. Mortar containing lime will adhere better to the tile, makes a neater job and results in a saving in labor. Too much lime must not be used as it weakens the mortar. A straight lime mortar, however rich the mixture, is not suitable for setting NATCO Hollow Tile. A sand containing a quantity of loam must not be used for cement plastering or stucco.

Sand containing a little clay may be used if the grains are not coated.

Table gives quantities of mortar materials required to lay up 1,000 pieces of NATCO Hollow Tile (pieces not square feet) of the various sizes given. This table allows about 10 per cent for waste and is based on the mixture that is recommended for NATCO Hollow Tile construction, consisting of one part Portland cement and three parts sand, to which 15 per cent of hydrated lime or lime putty is added.

For the convenience of builders the table gives the quantities of lime both by measure and weight for lump lime and by weight for hydrated lime.

Table of Quantities for Cement Mortar

MATERIALS REQUIRED TO LAY UP 1,000 PIECES OF NATCO HOLLOW TILE

Barrel of Cement Specified to be 3.8 cu. ft.

Size of Tile	Thickness of Wall	Approximate Quantity of Mortar, Cu. Ft.	Mortar Materials Required				15% These Quantities For Ordering Lump Lime in Lbs.
			Cement Sacks	Sand, Cu. Ft.	15% Dry Hydrated Lime, Lbs.	15% Lump Lime Paste, Cu. Ft.	
4x5x12	4″	19.66	6.28	19.65	38	.94	28
5x4x12	5″	23.12	7.36	23.11	44	1.10	33
5x8x12	5″	28.91	9.24	28.89	55	1.38	42
8x5x12	8″	39.33	12.56	39.31	75	1.88	56
4x5x12 } 8x5x12 }	12″	59.02	18.88	59.02	113	2.83	85
4x12x12	4″	27.75	8.92	27.72	54	1.34	40
6x12x12	6″	41.66	13.32	41.66	80	1.99	60
8x12x12	8″	55.54	17.76	55.53	107	2.66	80
12x12x12	12″	83.33	26.64	83.32	160	3.99	120
					"A"	"B"	"C"

Use either one of Columns "A" and "B."

Column "A" is for dry hydrated lime purchased in bags.

Column "B" is for lump lime purchased by barrel or ton.

Column "C" gives the approximate quantity of lump required to make the amount of lime paste given in Column "B."

A barrel of lump lime containing approximately 3 cubic feet, weighing 185 pounds net will produce about 6. to 6.5 cubic feet lime paste which, on account of water added will weigh about 70 pounds per cubic foot.

NOTE—In giving size of tile, the first number always indicates the thickness of wall, the second the width of tile and the third, the length to which it is cut.

A cubic foot of hydrated lime weighs 40 lbs.

A cubic foot of cement weighs 100 lbs.

Therefore, at 15% there will be 6 lbs. of hydrated lime to add to each cubic foot of cement.

"Dont's" Which Merit Your Consideration

Don't have your hollow tile dumped from a truck, but have each size of the tile stacked by itself. This will save time and money when your masons are ready for tile, besides doing away with breakage.

Don't patch up your job with brick. NATCO Hollow Tile are made in proper shapes and sizes; it is therefore very seldom necessary to use brick.

Don't use too much lime in your mortar. It weakens the mortar and spoils your reputation.

Don't fail to cover up the top course of tile in wall at quitting time. This protects your work and prevents the filling of cells with rain or snow.

Don't leave any holes or crevices on the outside or inside of the wall. Be sure all joints are well sealed. Above all, do not depend upon the stucco to fill up the mortar joints.

Don't allow your mason to break up a lot of tile when they require small pieces, as we ship a percentage of fractional tile in each order.

Don't use the nest of 1-inch slabs as full tile. They should be broken apart and single slabs used for bearing under joists, for working up to the story heights, sills, etc.

Don't cut holes into the tile in which to frame your joists, but use the facing tile at ends of beams, and other tile between beams. Remember that the strength of your wall depends upon thorough bearing of webs and shells, and every hole weakens the wall, and is the easiest way for dampness to penetrate.

Don't forget to put proper drips on the underside of the sills. This is very important.

Don't use special arch lintels for spans wider than 5 feet. These should be made of stock tile reinforced or concrete girders faced with tile.

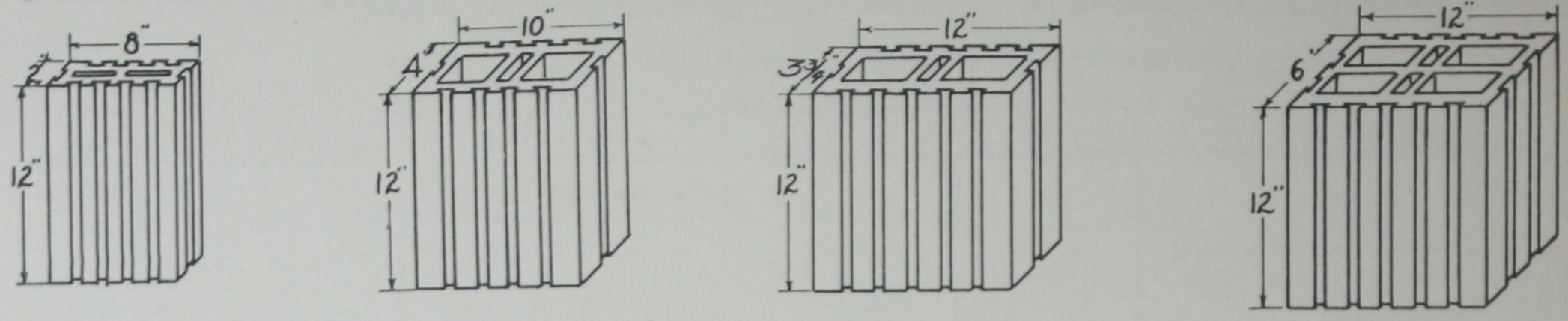
Don't forget that all wooden frame work will shrink; therefore, special care should be taken to thoroughly calk between all wood work and hollow tile.

Don't forget to use a good waterproofing compound in the finish coat of your stucco, if the house is situated in a position exposed to driving storms.

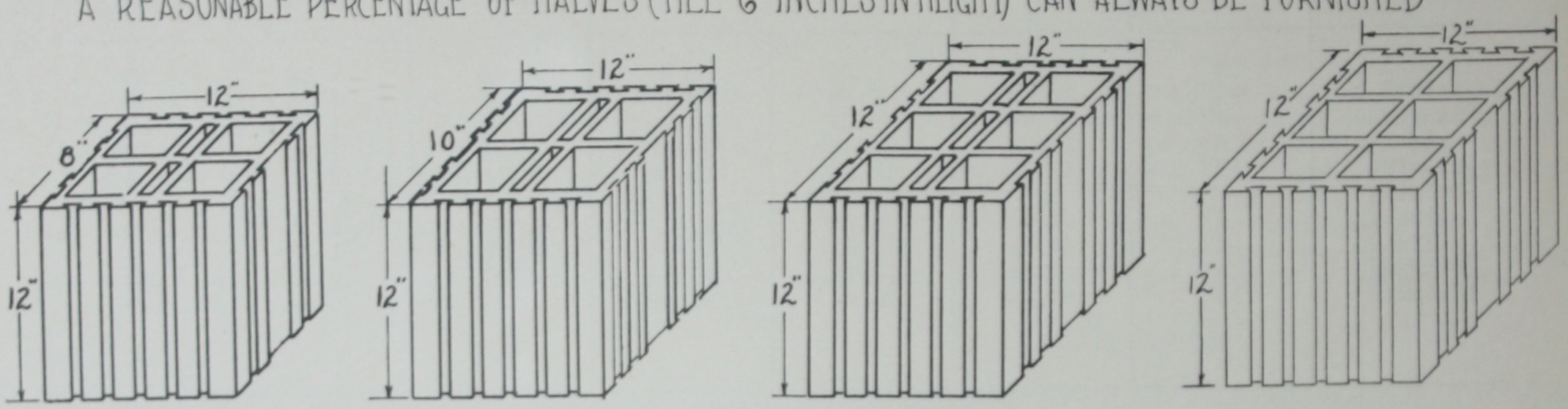
Don't try to apply stucco during freezing weather.

Don't guess where the various sizes of tile are to be used, as we will gladly make notations of different sizes, etc., on plans, if you will send them to us, or we will send our representative to see you. Remember that we are glad to give you any information for we are just as anxious as you are to have the work satisfactory.

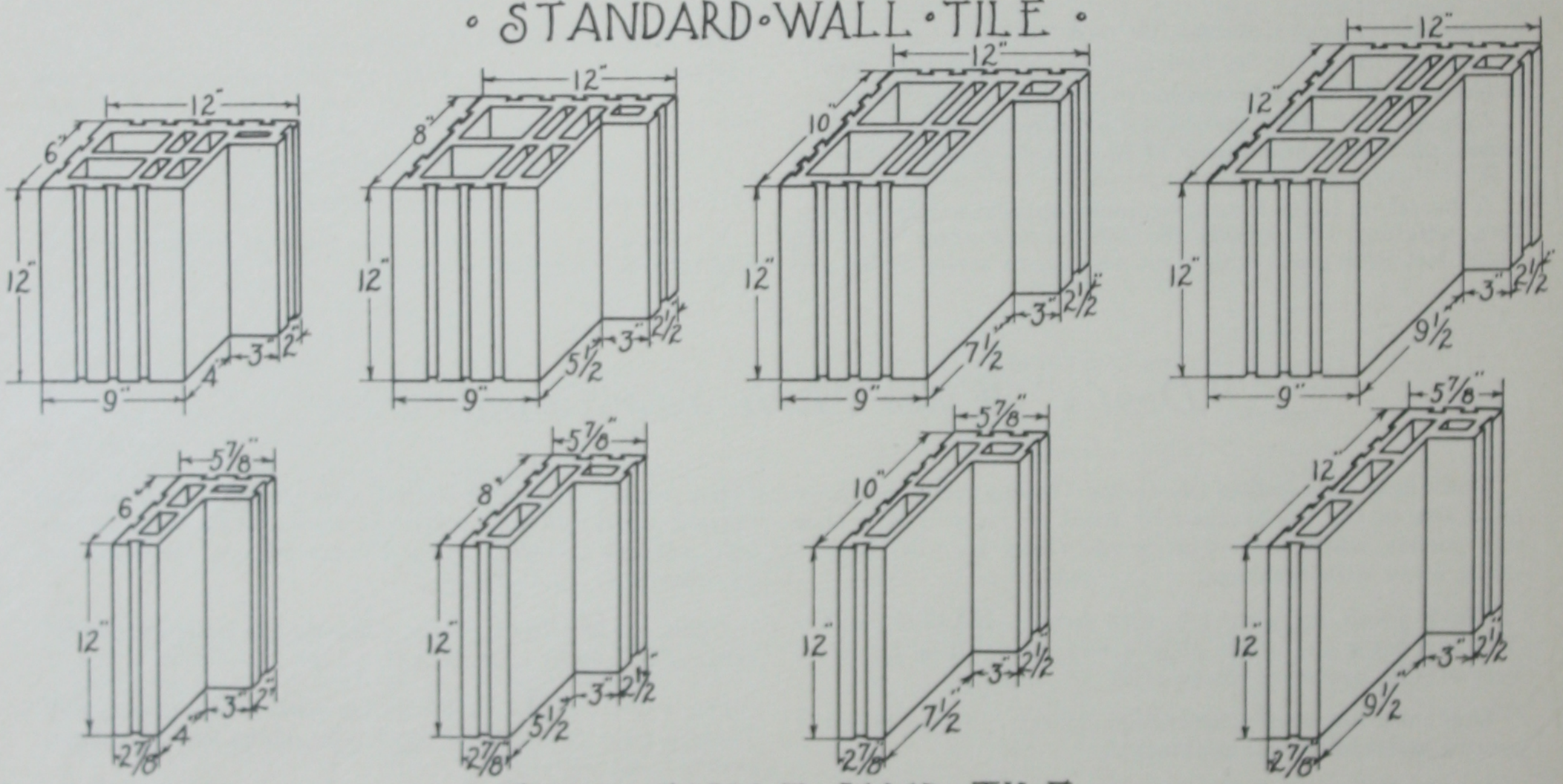
DETAILS OF SHAPES & SIZES OF NATCO XXX TILE



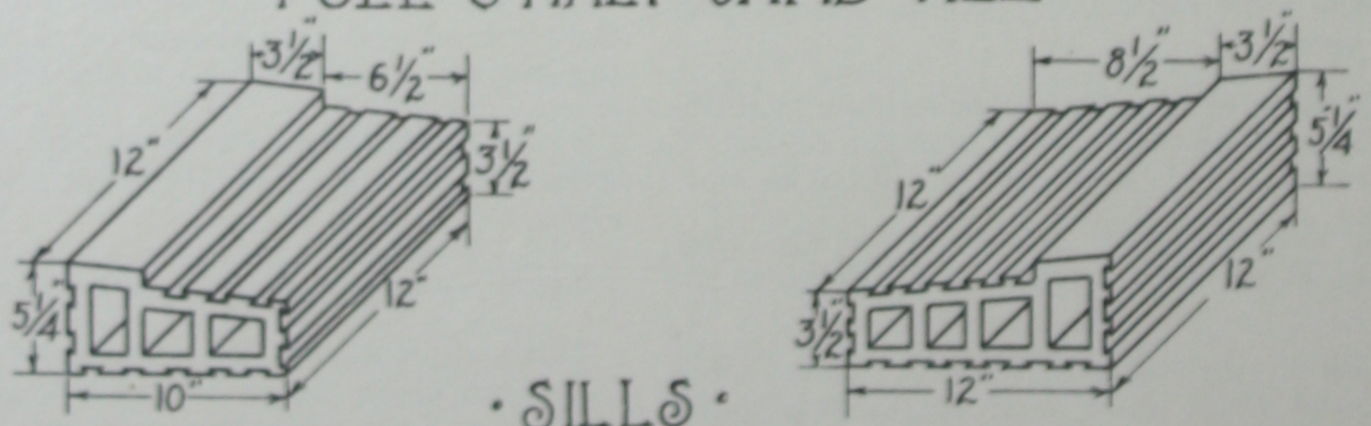
A REASONABLE PERCENTAGE OF HALVES (TILE 6 INCHES IN HEIGHT) CAN ALWAYS BE FURNISHED



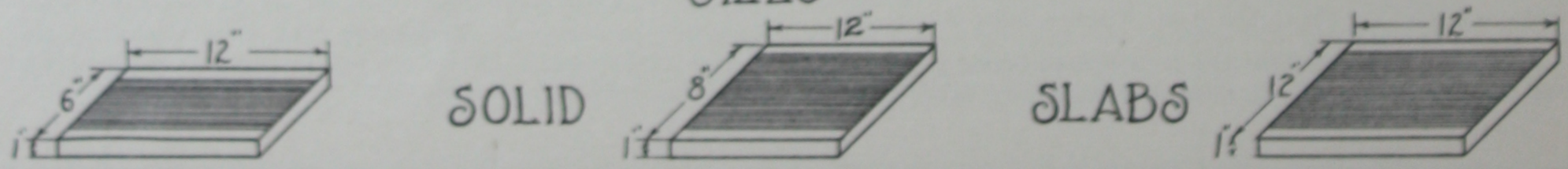
STANDARD WALL TILE

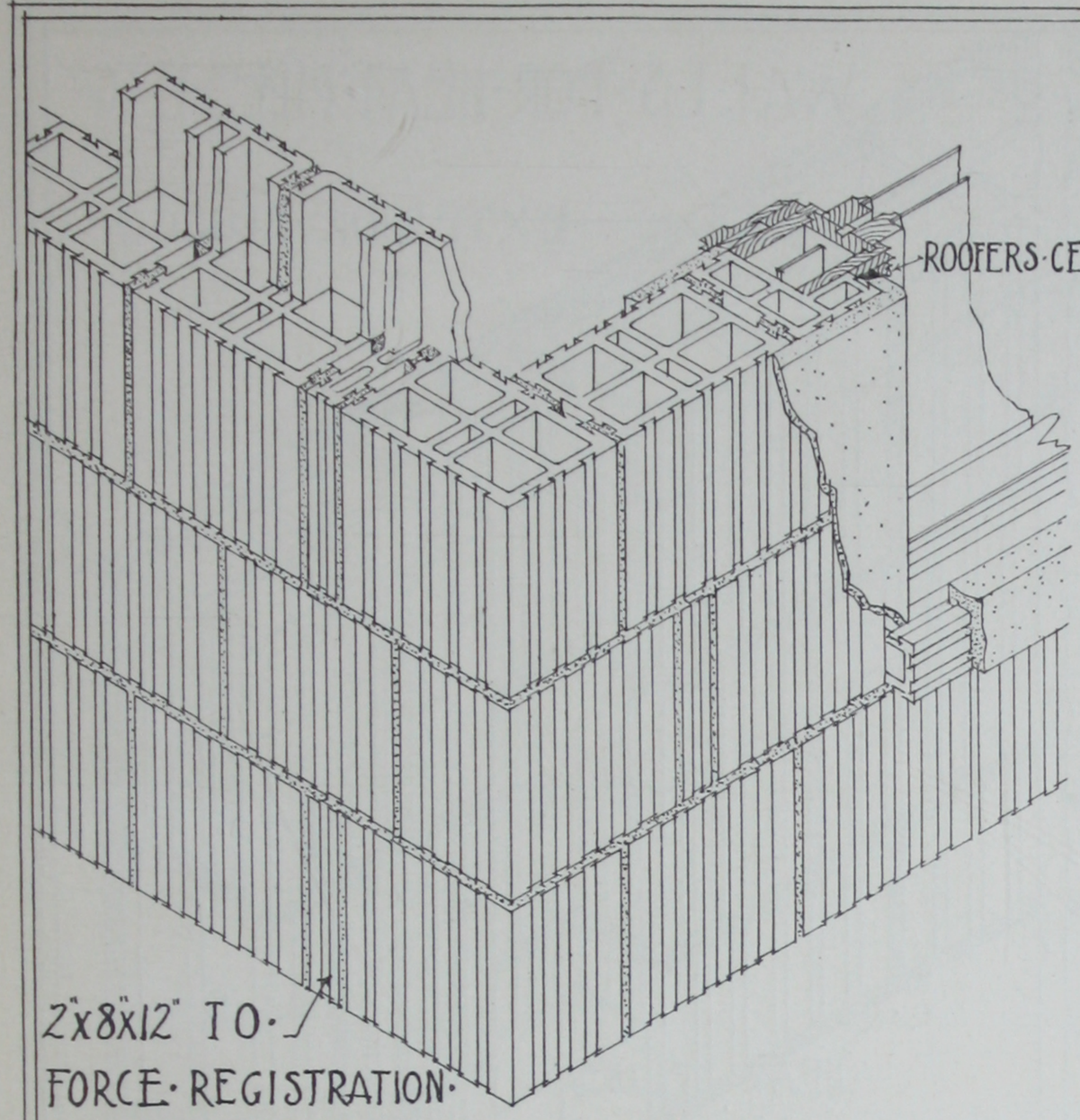


FULL & HALF JAMB TILE

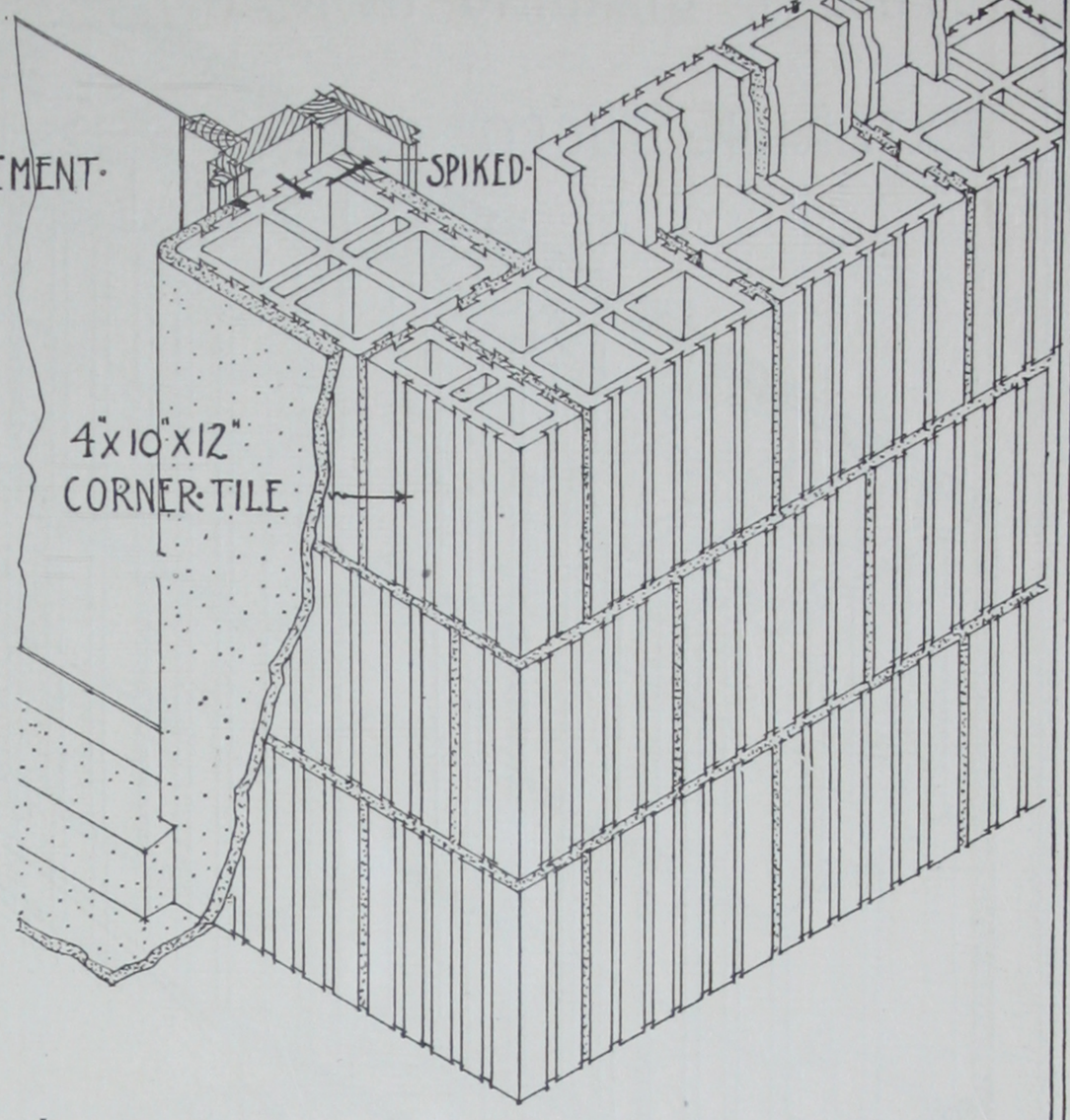


SILLS

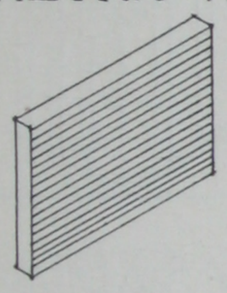




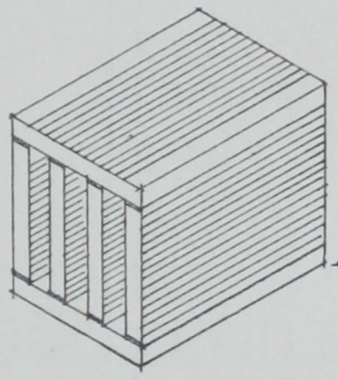
ISOMETRIC·VIEW·OF·8 INCH·TILE·WALL·



·ISOMETRIC·VIEW·OF 10' TILE·WALL·

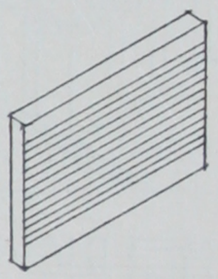


ISOMETRIC·VIEW·OF NEST·AS·
·MANUFACTURED·

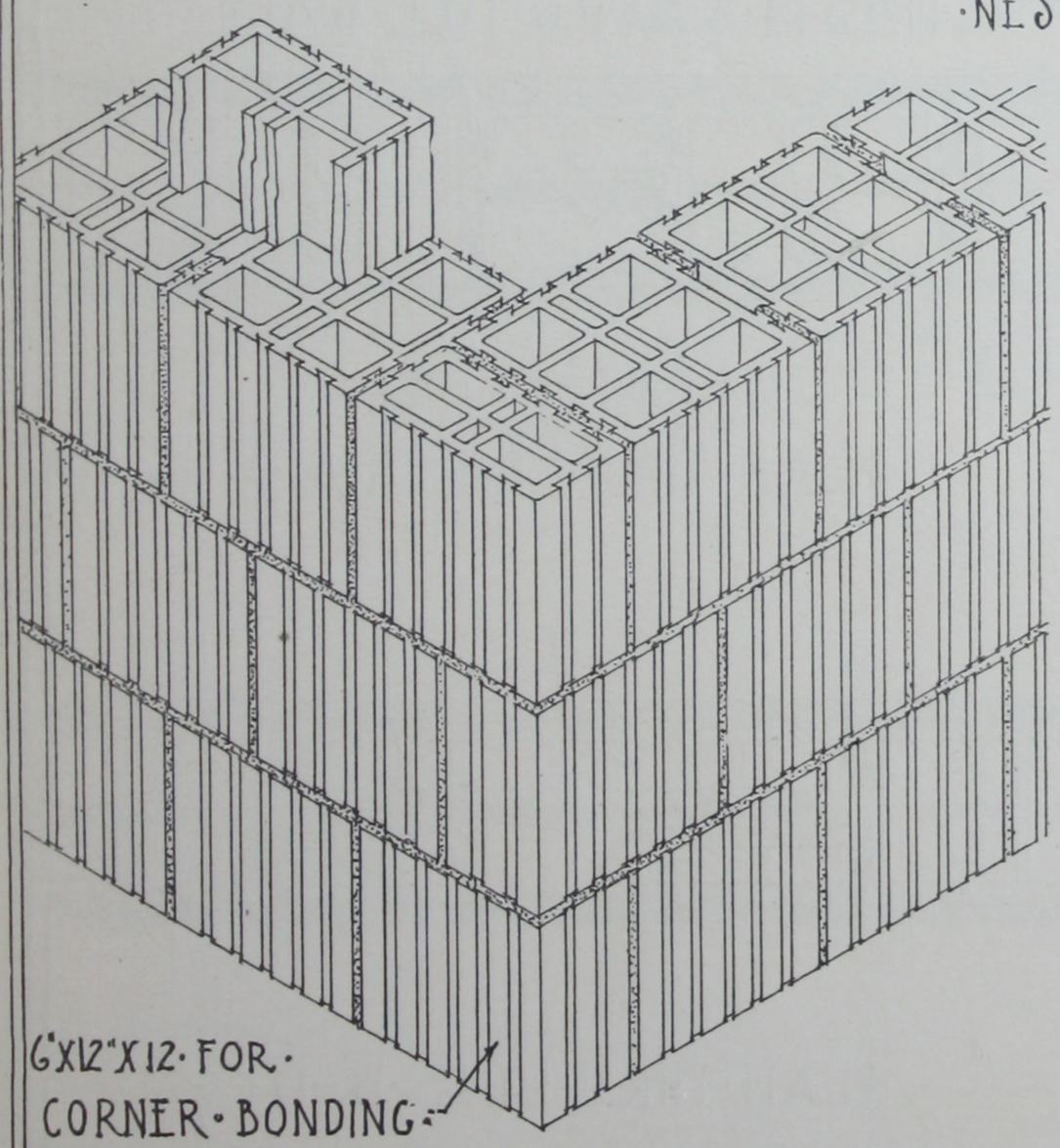


·NEST·OF·1 INCH·SLABS·

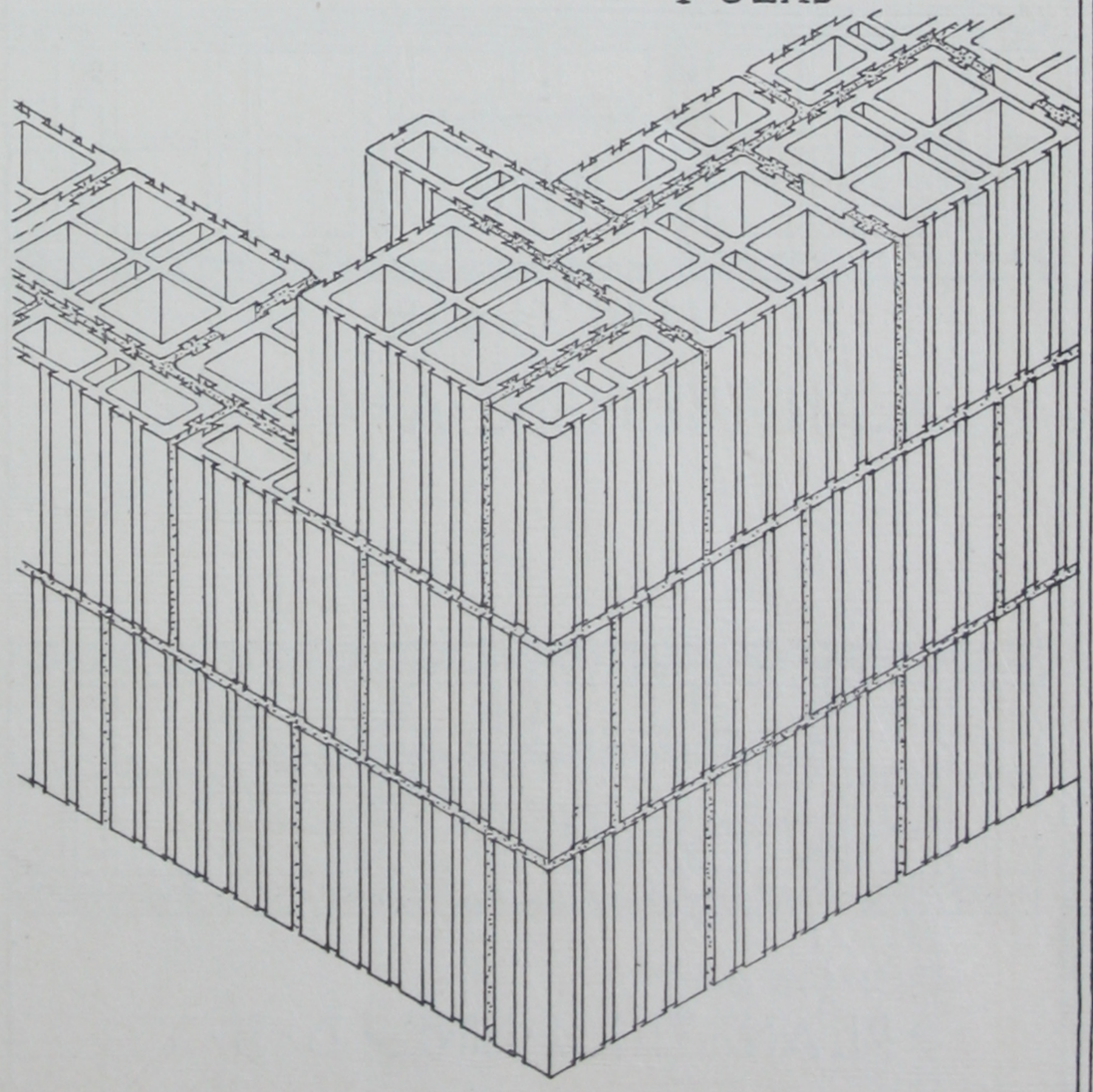
·TAP·ON CORNERS·TO·
—SEPARATE·SLABS·



·ISOMETRIC·VIEW·OF·SINGLE
·1" SLAB·

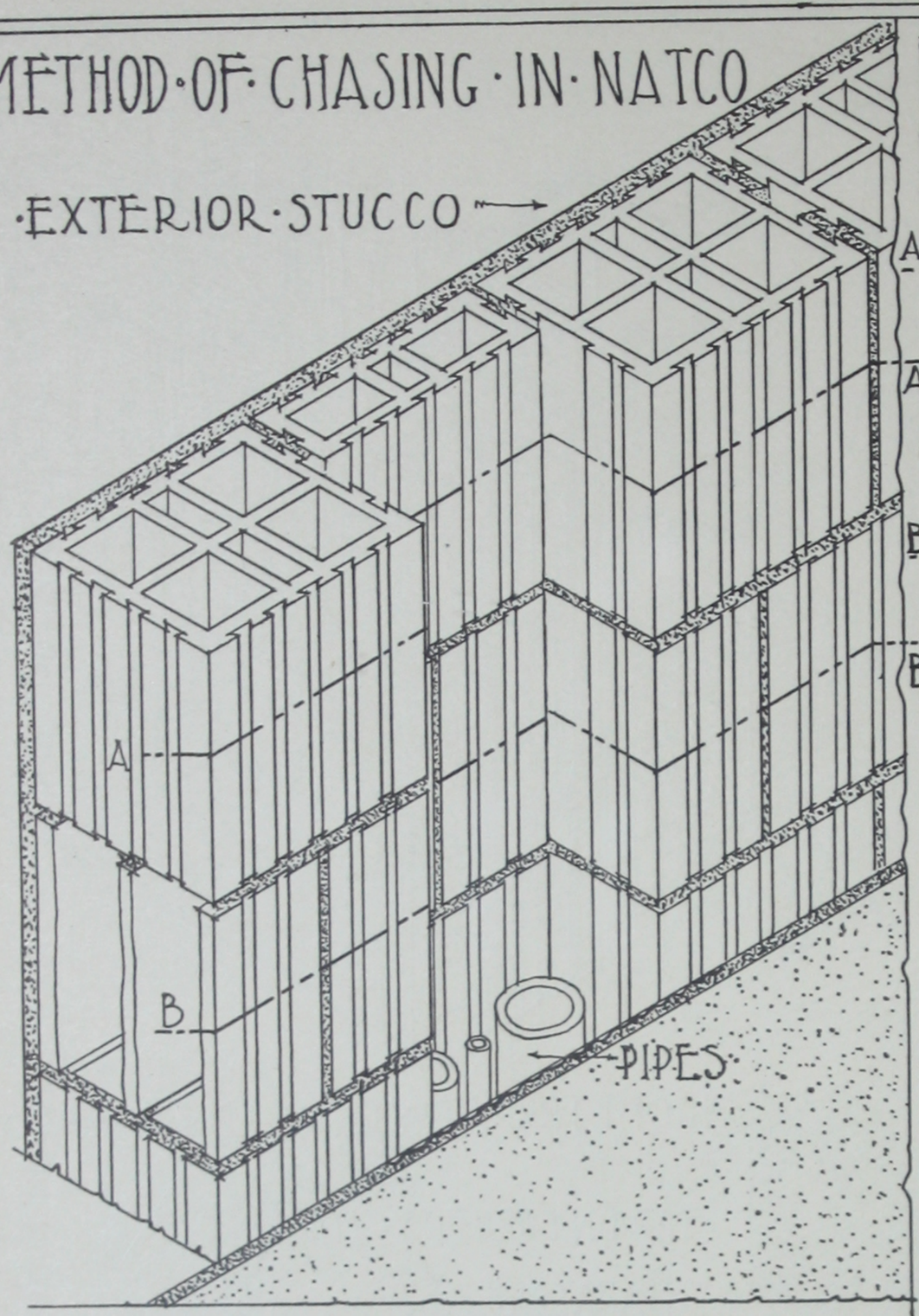


ISOMETRIC·VIEW·OF·12" TILE WALL

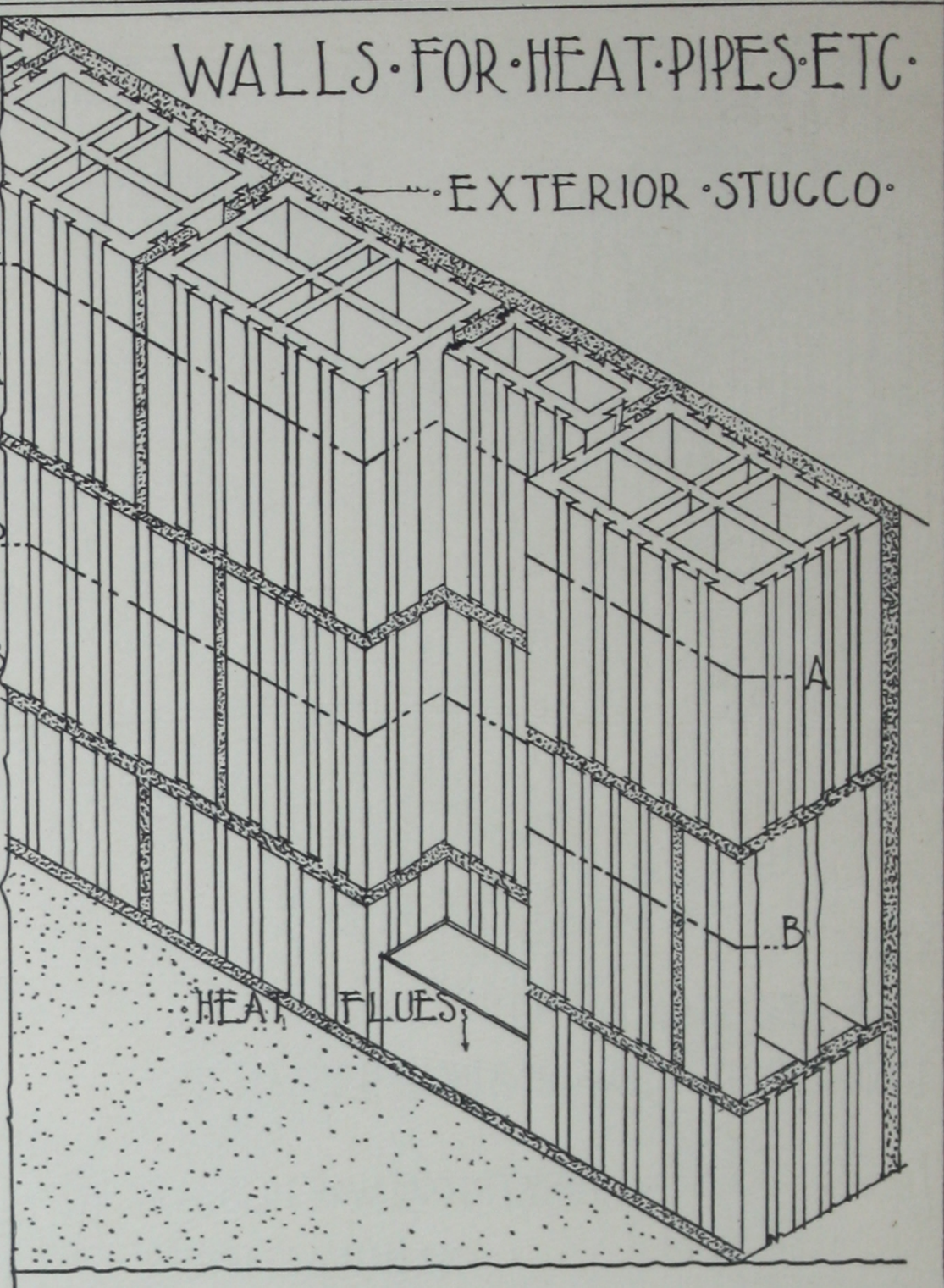


·ISOMETRIC·VIEW·OF·14" TILE WALL·

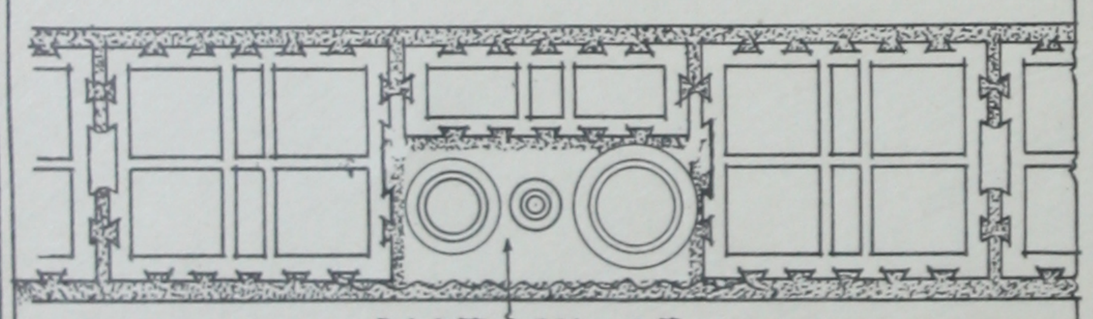
METHOD OF CHASING IN NATCO WALLS FOR HEAT PIPES ETC.



ISOMETRIC VIEW SHOWING 6" x 12" CHASE FOR PIPES IN 10" NATCO TILE WALL

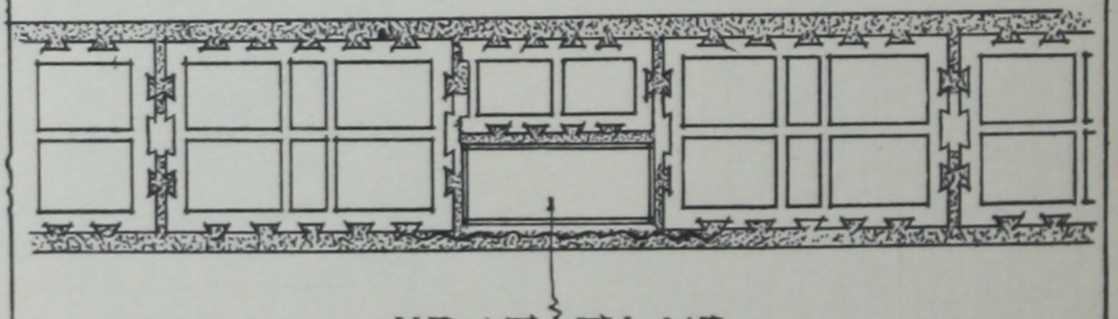


ISOMETRIC VIEW SHOWING 4" X 9" CHASE FOR PIPES IN 8" NATCO TILE WALL



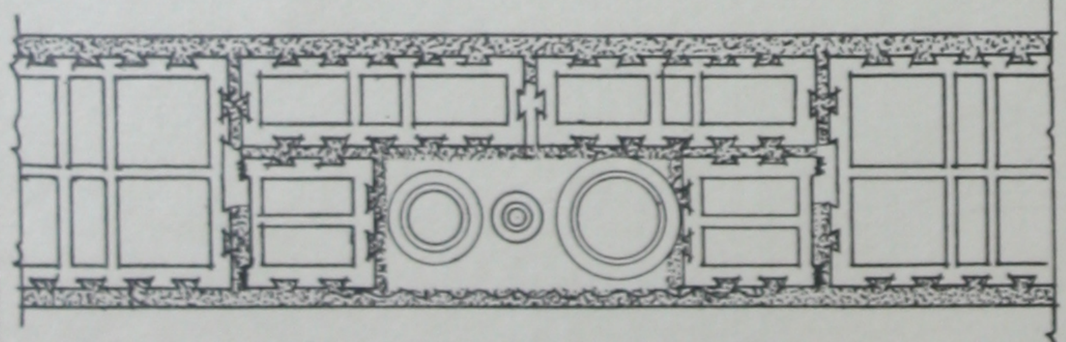
PIPE CHASE

PLAN THRU LINE A A

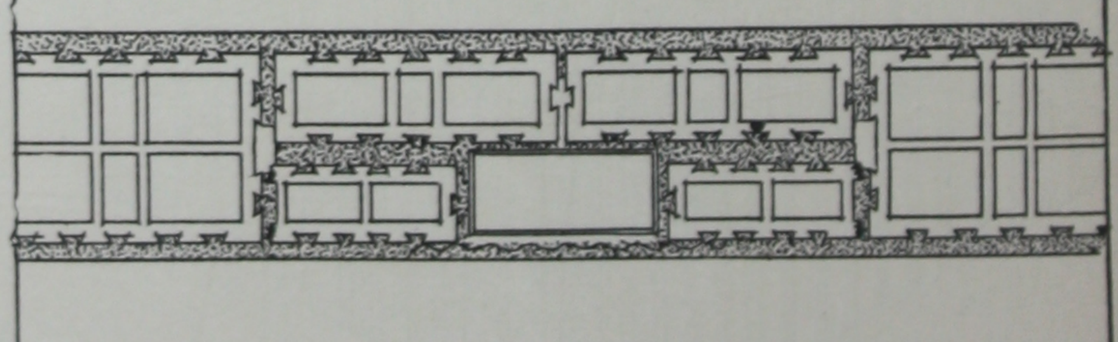


HEAT FLUE

PLAN THRU LINE A A



PLAN THRU LINE B B



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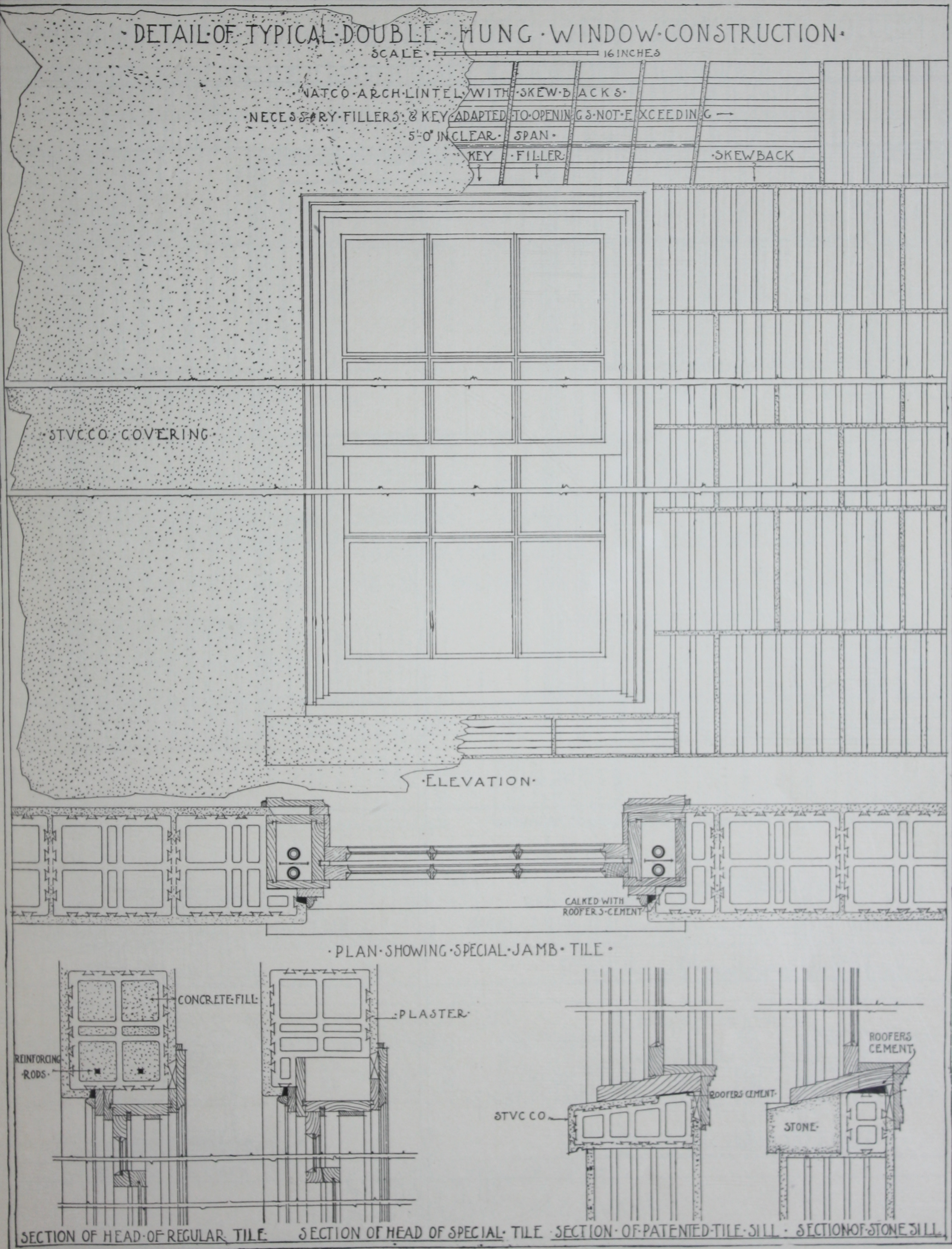
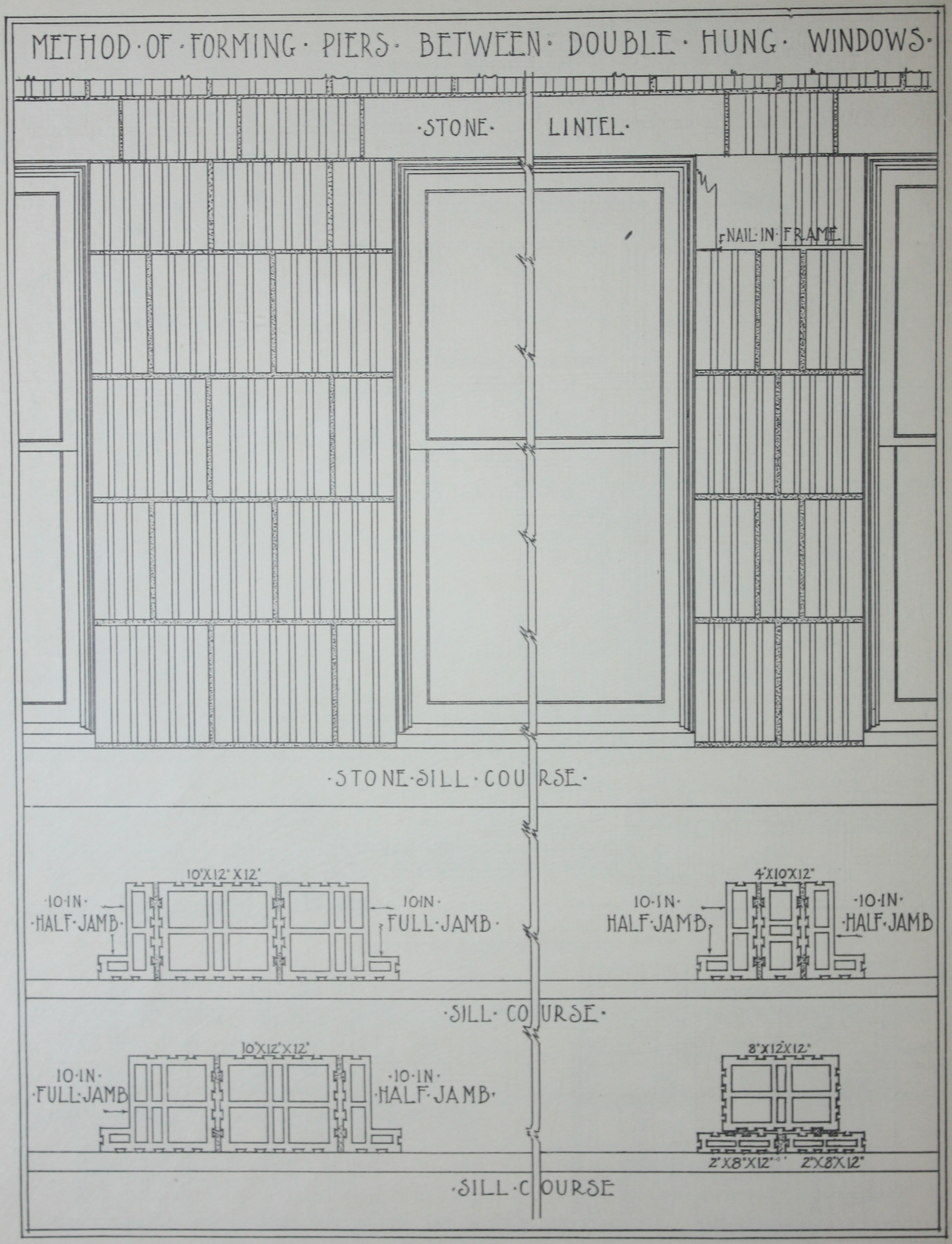
DETAIL OF TYPICAL DOUBLE HUNG WINDOW CONSTRUCTION

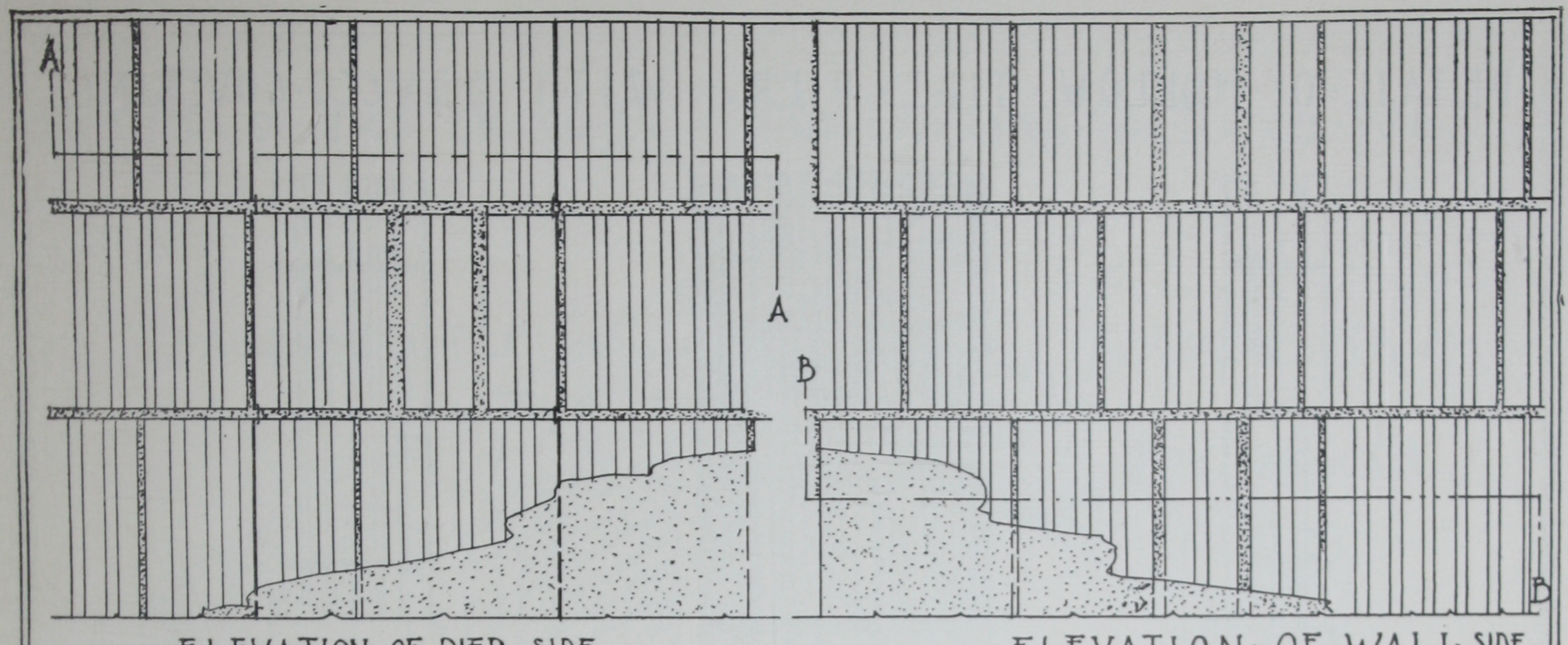
SCALE 16 INCHES



SECTION OF HEAD OF REGULAR TILE SECTION OF HEAD OF SPECIAL TILE SECTION OF PATENTED TILE SILL SECTION OF STONE SILL

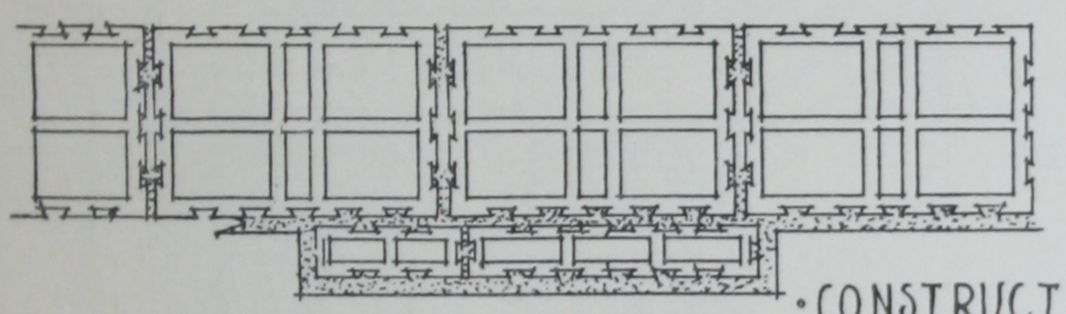
METHOD OF FORMING PIERS BETWEEN DOUBLE HUNG WINDOWS





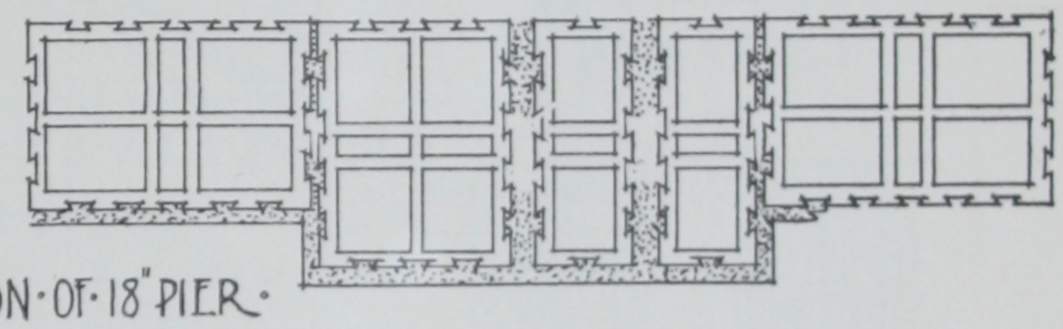
·ELEVATION·OF·PIER·SIDE·

·ELEVATION·OF·WALL·SIDE·



·CONSTRUCTION·OF·18"PIER·
·IN·AN·8"HOLLOW·TILE·WALL·

·PLAN·AT·COURSE·A·A·



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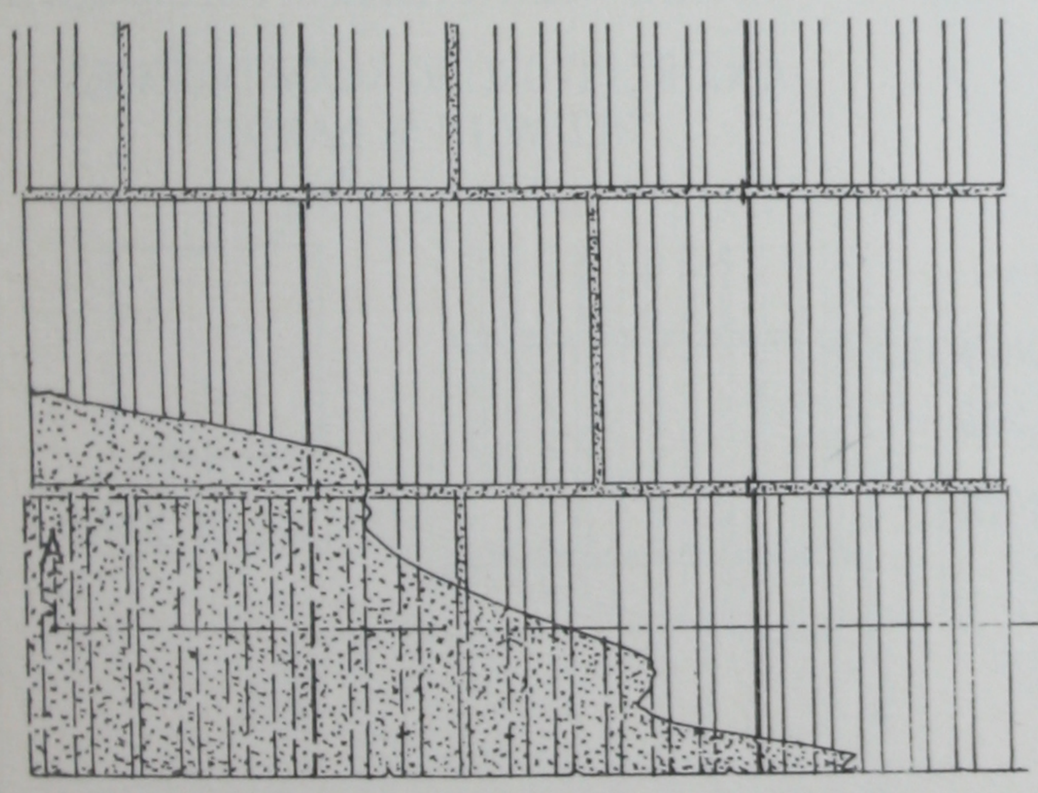
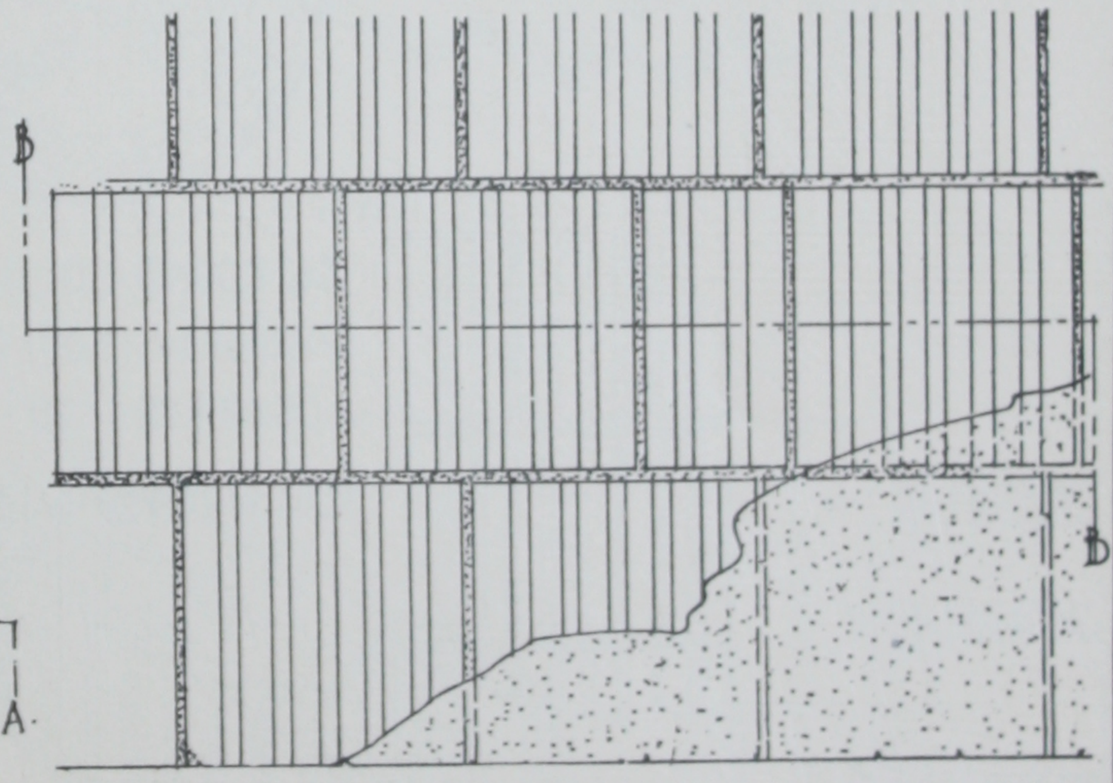
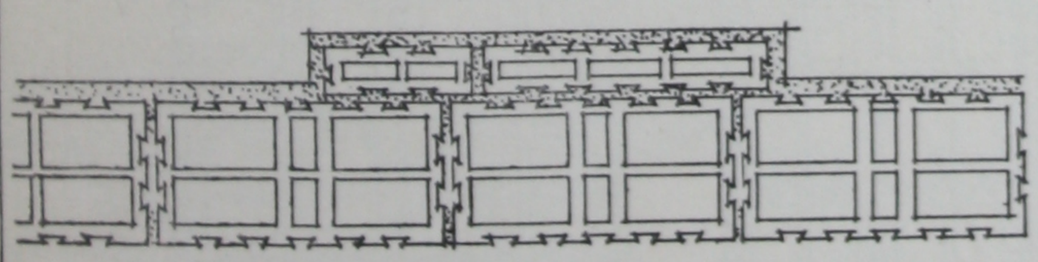


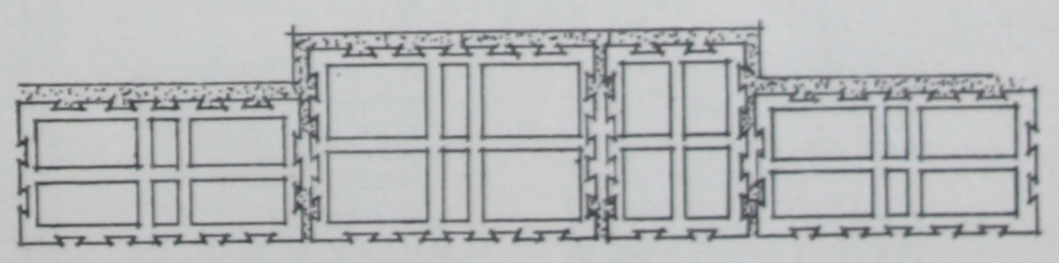
·ELEVATION·OF·PIER·SIDE·



ELEVATION·OF·WALL·SIDE·



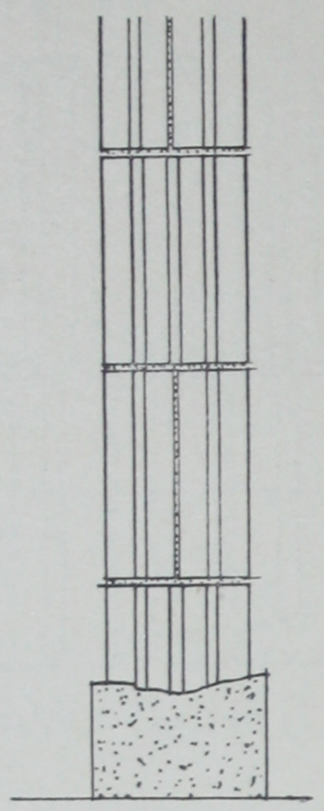
·PLAN·AT·COURSE·A·A·



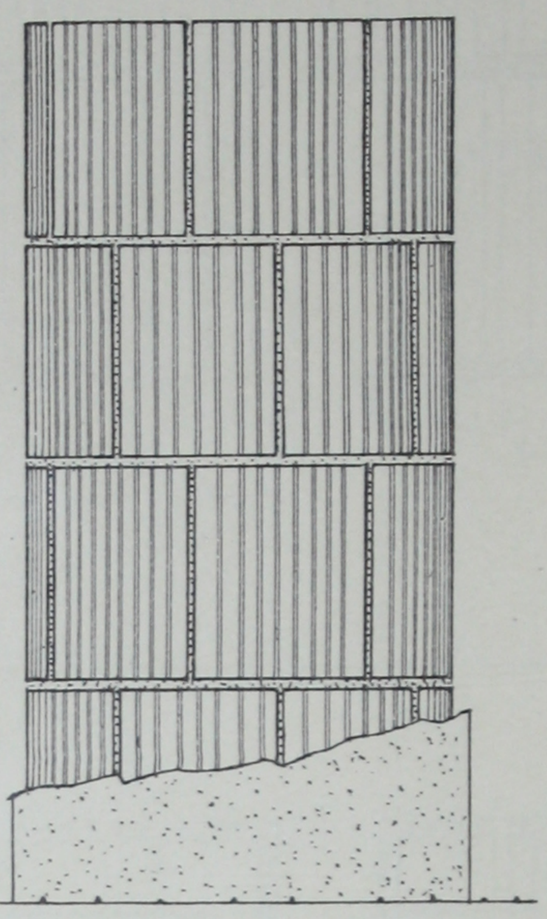
·PLAN·AT·COURSE·B·B·

·CONSTRUCTION·OF·18"PIER·
·IN·A·6"HOLLOW·TILE·WALL·

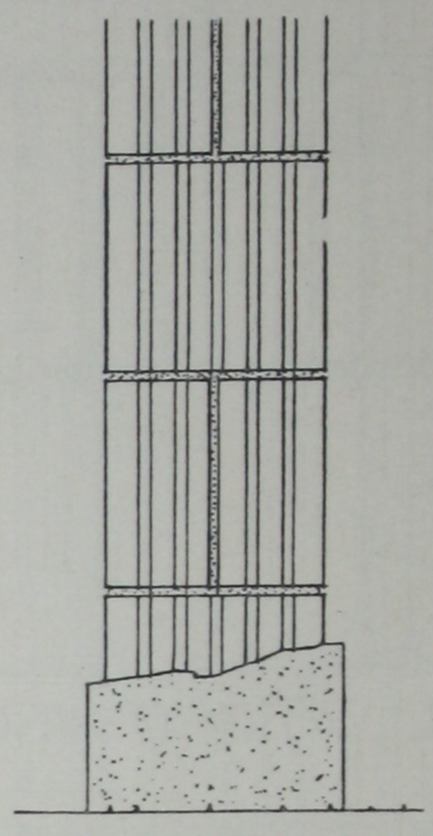
DETAIL OF HOLLOW TILE PIERS WITH STUCCO COVERING



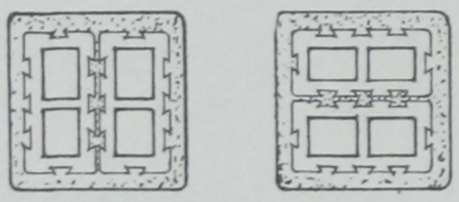
ELEVATION



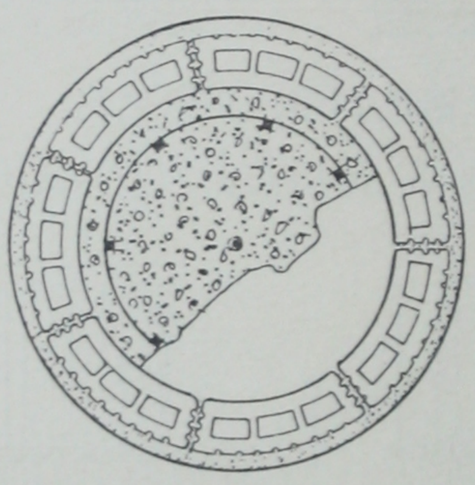
ELEVATION



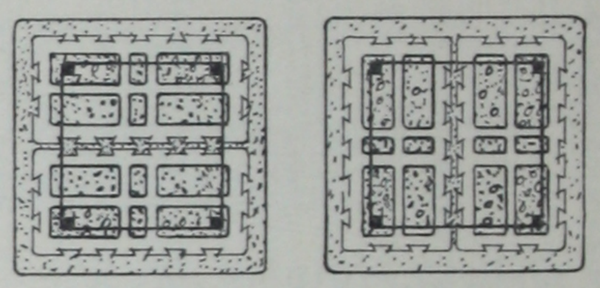
ELEVATION



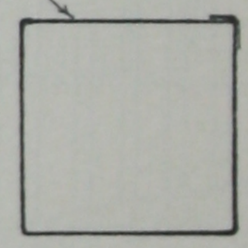
PLANS OF 10" TILE PIER 4"x8" TILE



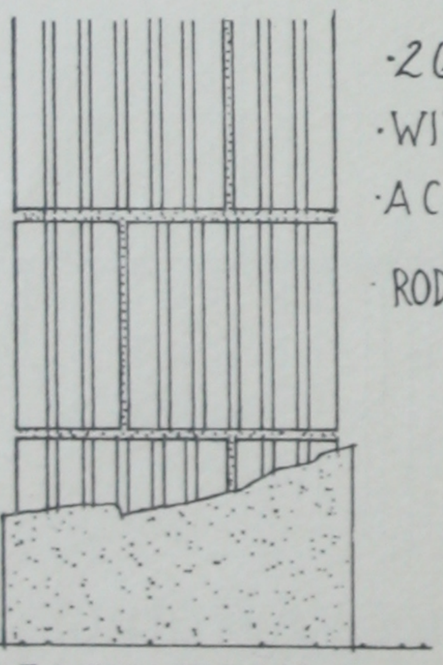
26" ROUND COLUMN
WITH OR WITHOUT REINFORCING
ACCORDING TO LOAD
RODS WRAPPED WITH WIRE



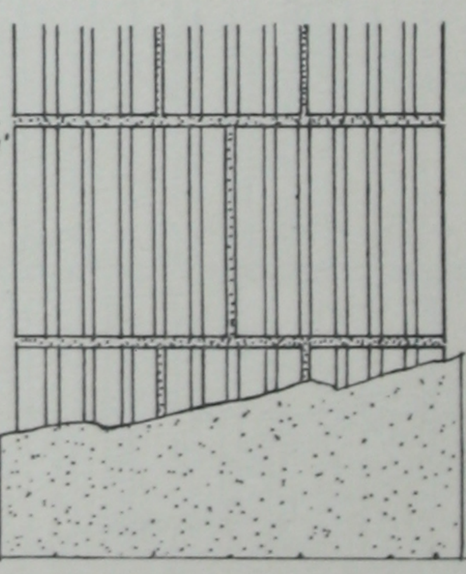
14" TILE PIER FILLED WITH CONCRETE
AND REINFORCING RODS AT CORNERS
TIED WITH 1/4" BANDS



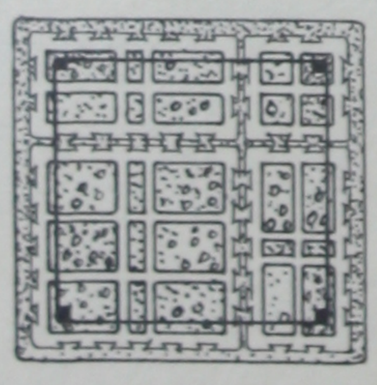
DETAIL OF BAND

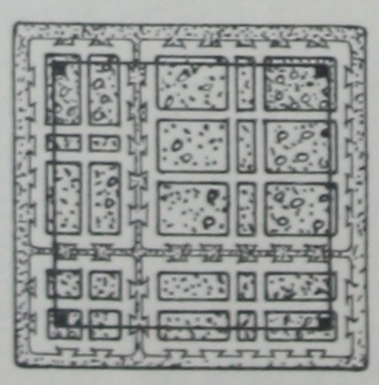


ELEVATION

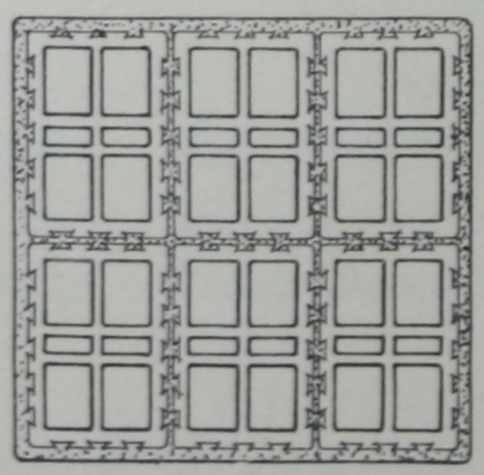


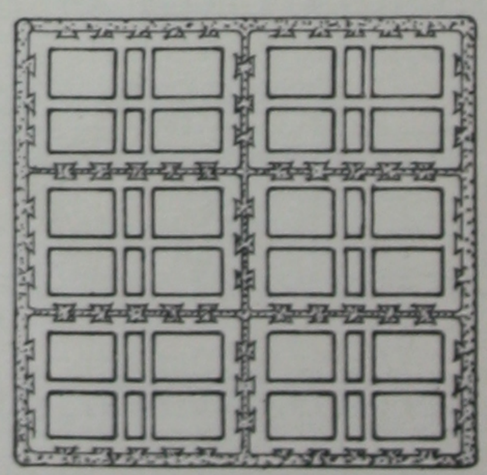
ELEVATION





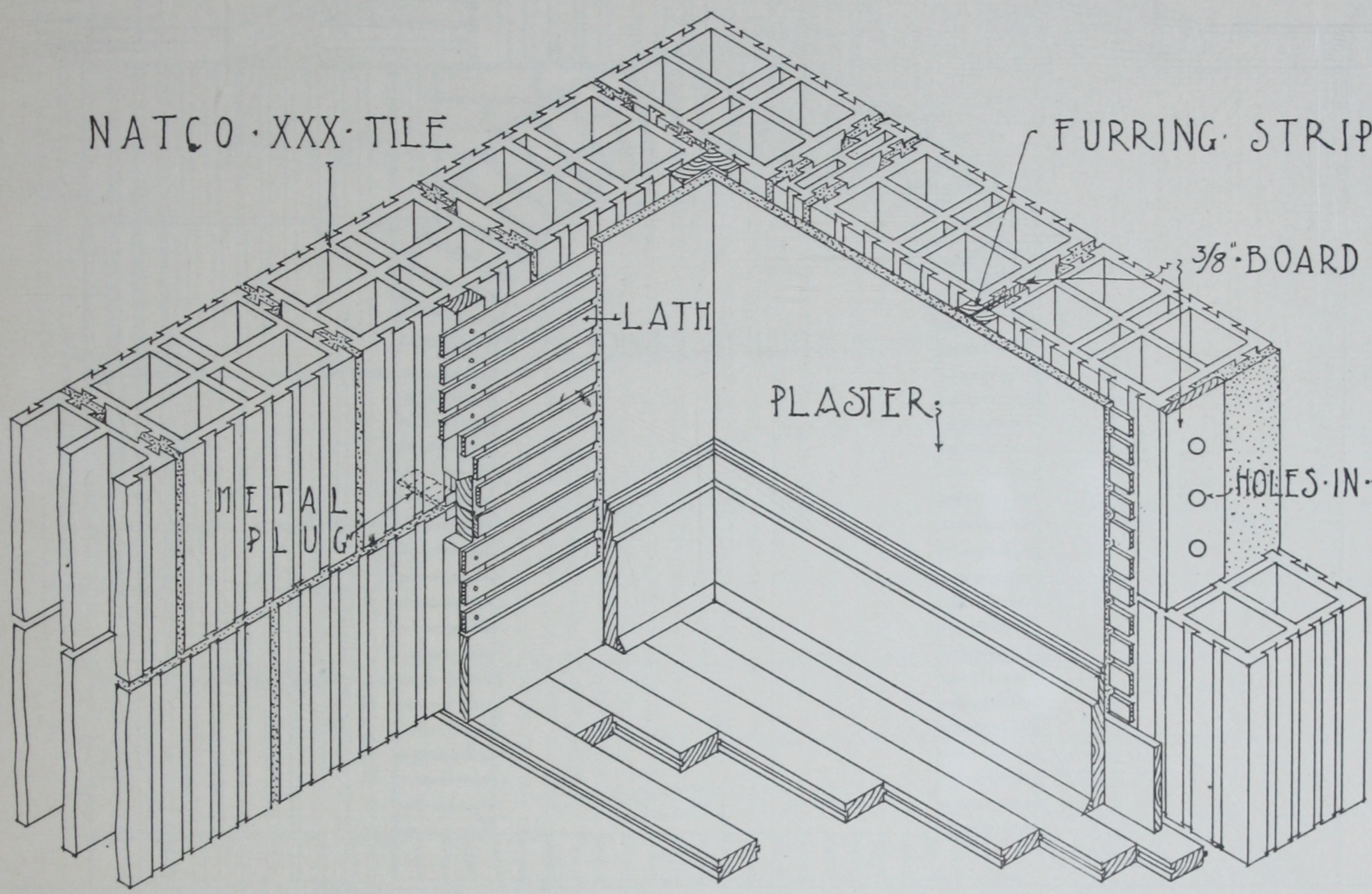
PLANS OF 20" PIER REINFORCING AT CORNERS
TIED WITH 1/4" BANDS



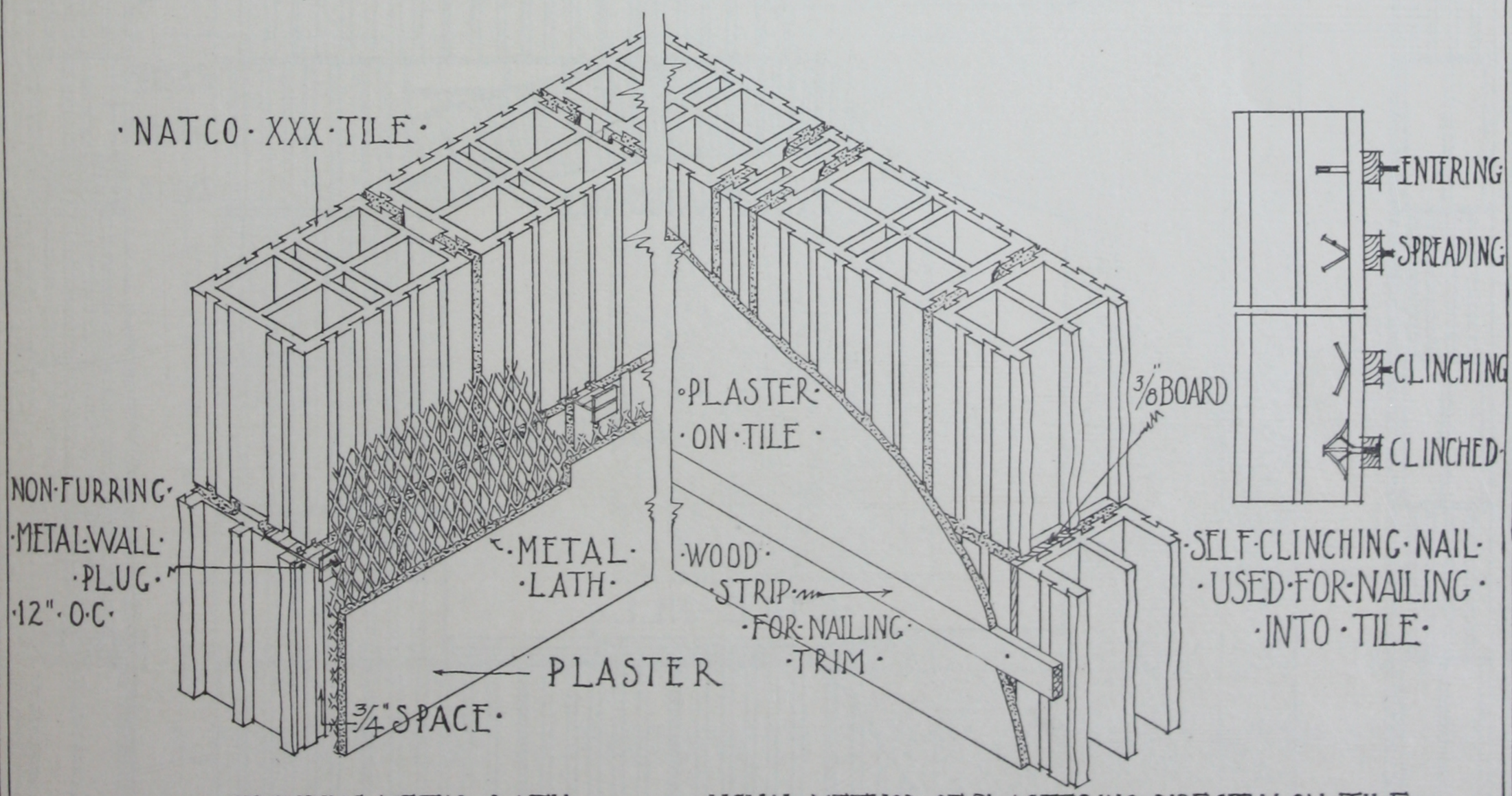


PLANS OF 26" PIERS

METHOD OF FASTENING TRIM AND FURRING TO NATCO WALLS

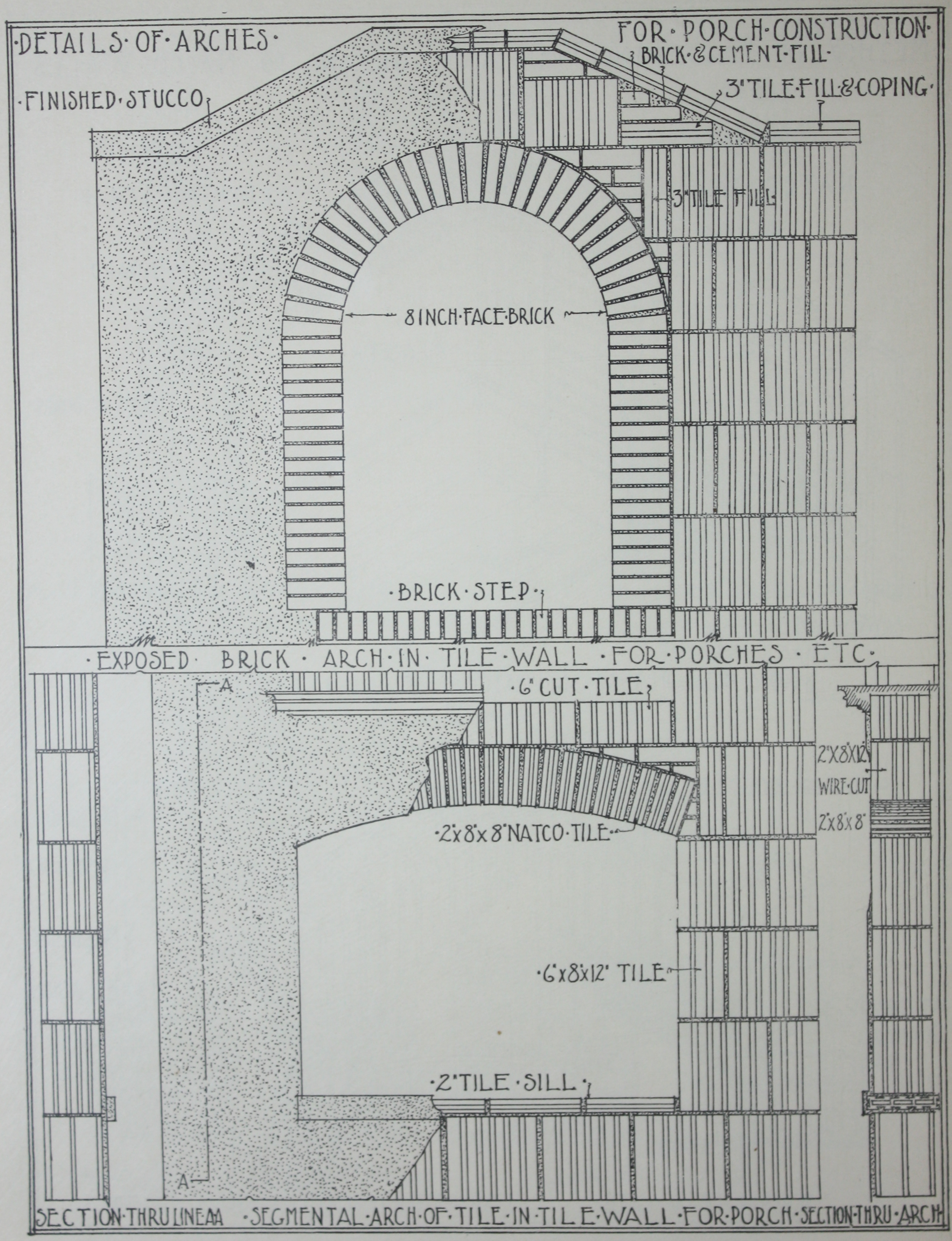


WOOD & METAL PLUGS IN NATCO TILE CONSTRUCTION

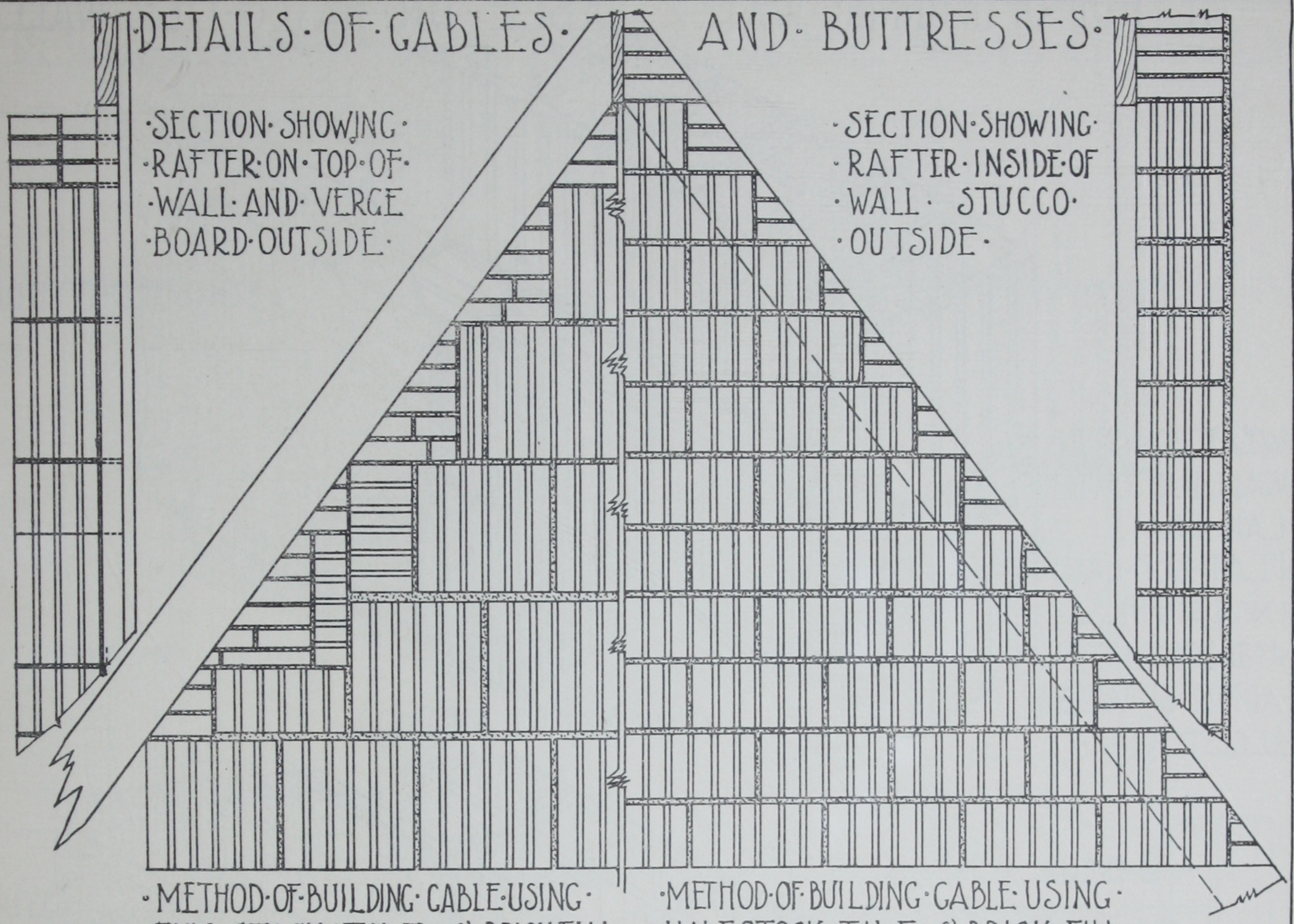


SECURING METAL LATH

USUAL METHOD OF PLASTERING DIRECTLY ON TILE


DETAILS OF ARCHES
FOR PORCH CONSTRUCTION
BRICK & CEMENT FILL
FINISHED STUCCO
3" TILE FILL & COPING
3" TILE FILL
8 INCH FACE BRICK
BRICK STEP
EXPOSED BRICK ARCH IN TILE WALL FOR PORCHES ETC
A
6" CUT TILE
2"X8"X12"
WIRE CUT
2"x8"x8"
2"x8"x8" NATCO TILE
6"x8"x12" TILE
2" TILE SILL
A
SECTION THRU LINE AA SEGMENTAL ARCH OF TILE IN TILE WALL FOR PORCH SECTION THRU ARCH

DETAILS OF GABLES AND BUTTRESSES



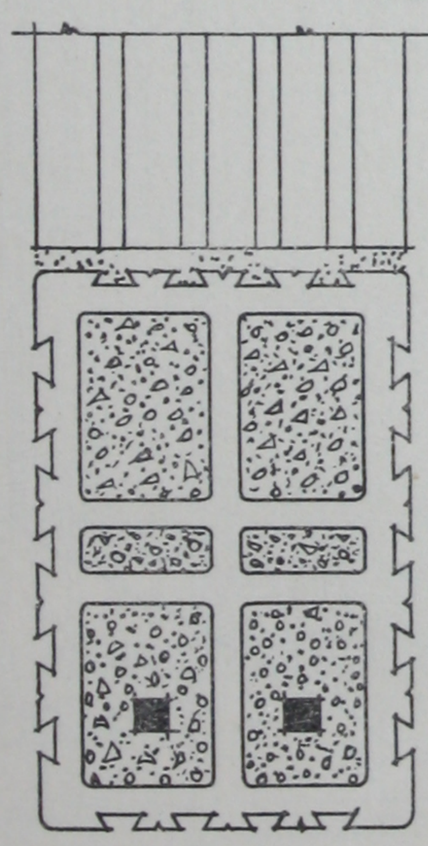
SECTION SHOWING RAFTER ON TOP OF WALL AND VERGE BOARD OUTSIDE

SECTION SHOWING RAFTER INSIDE OF WALL STUCCO OUTSIDE

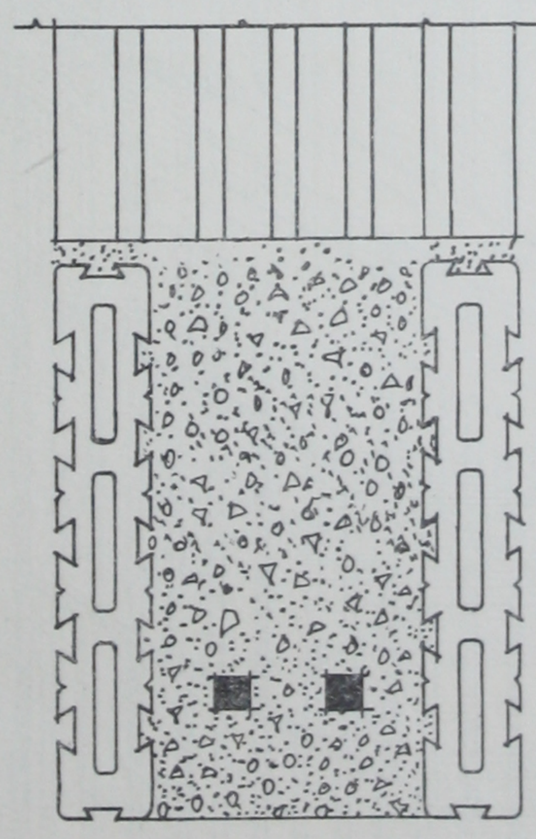
METHOD OF BUILDING GABLE USING FULL STOCK TILE & BRICK FILL

METHOD OF BUILDING GABLE USING HALF STOCK TILE & BRICK FILL

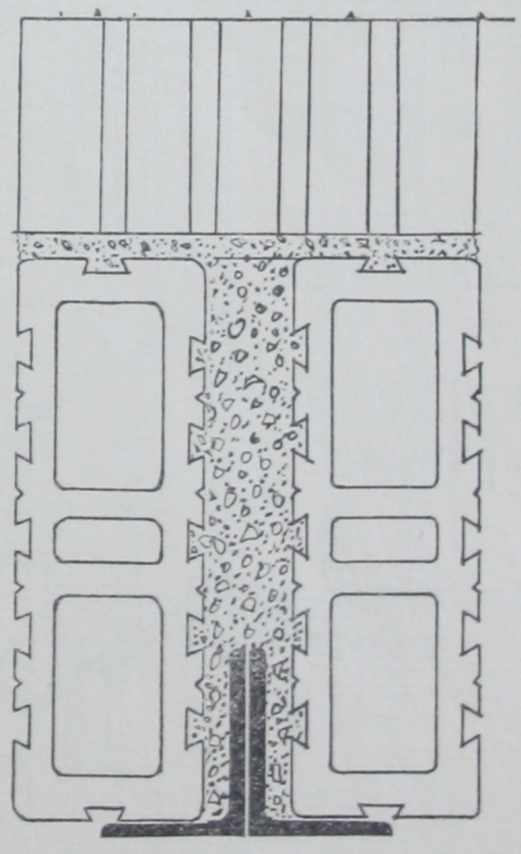
LINTEL SECTIONS



STOCK TILE REINFORCED

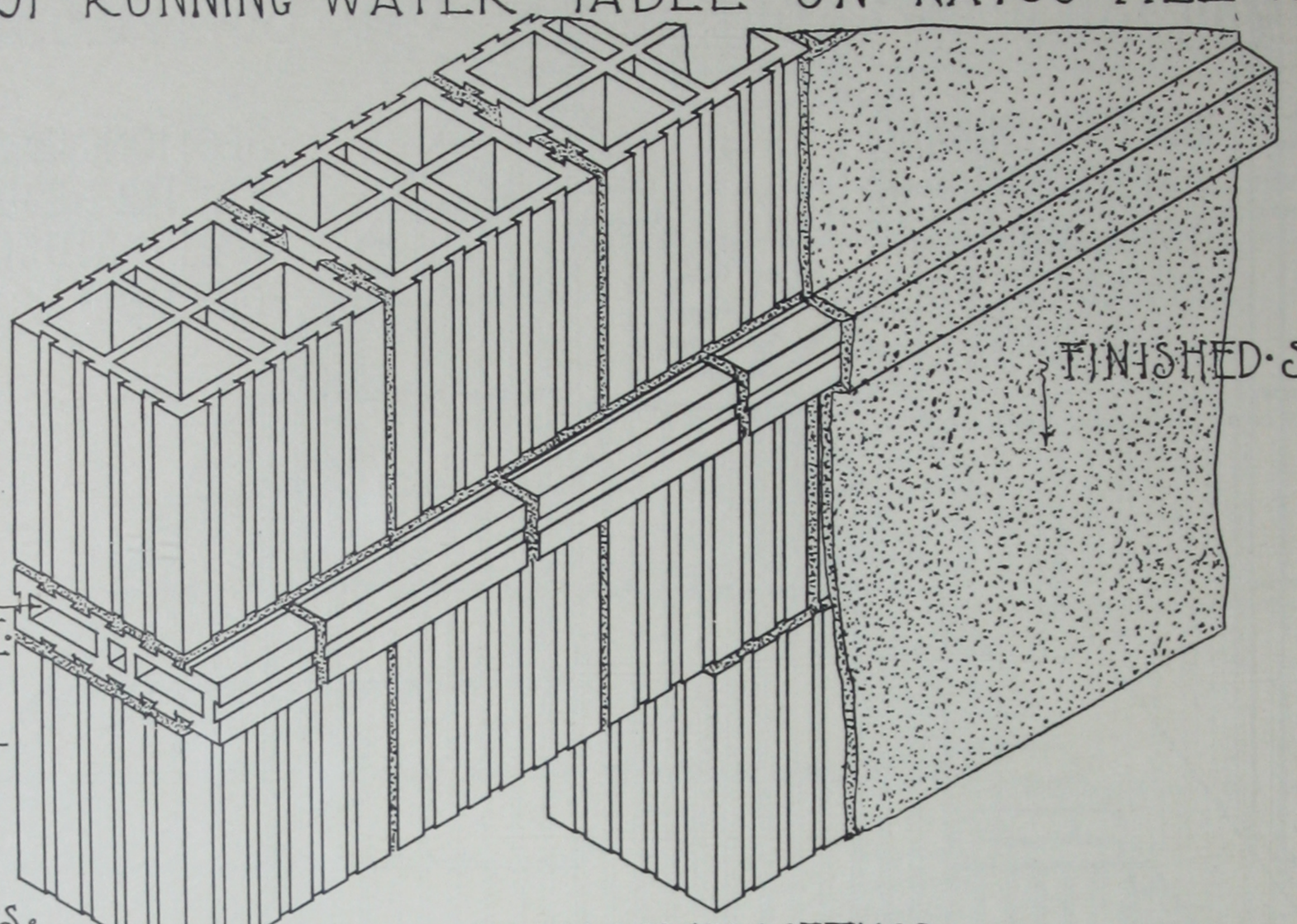


CONCRETE BEAM FACED WITH 2" TILE

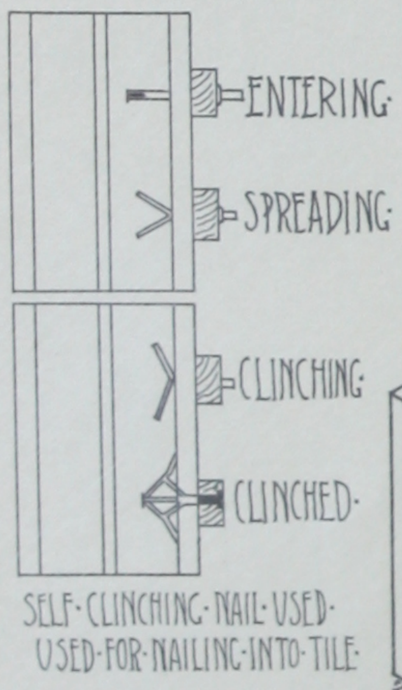


STOCK 3¾" TILE LINTEL WITH ANGLES

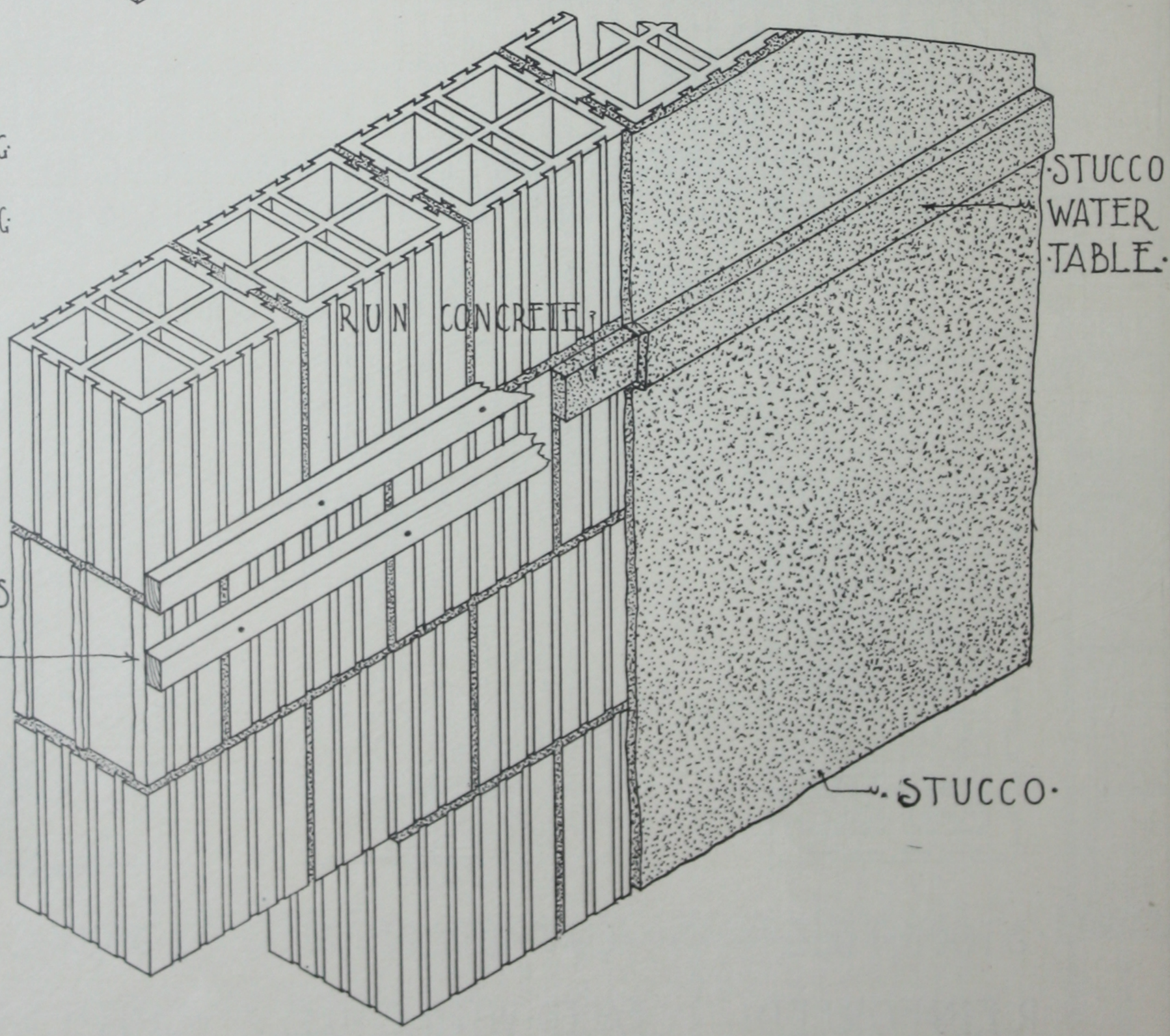
METHOD OF RUNNING WATER TABLE ON NATCO TILE WALL



INCORRECT METHOD

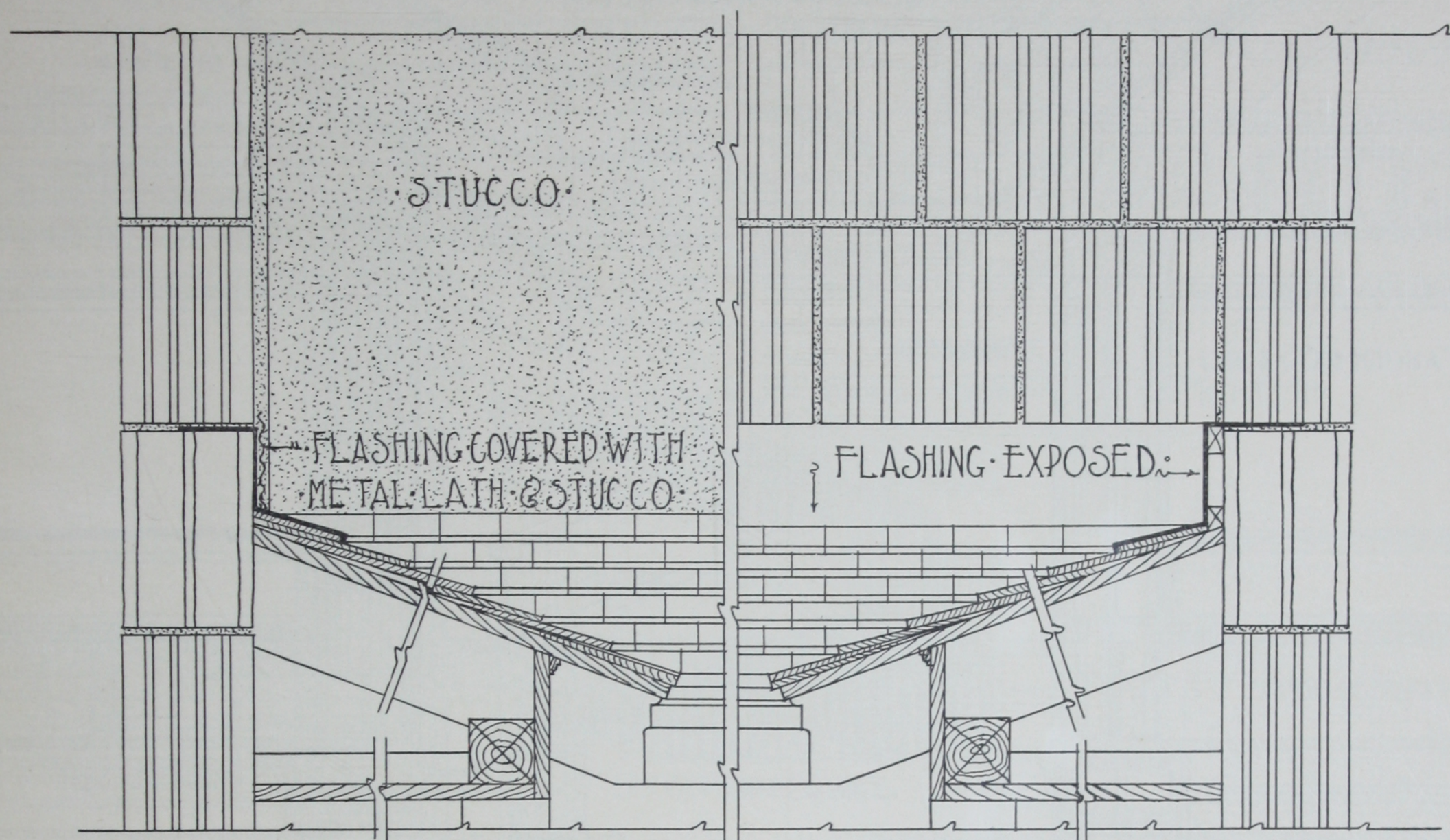


SELF CLINCHING NAIL USED FOR NAILING INTO TILE

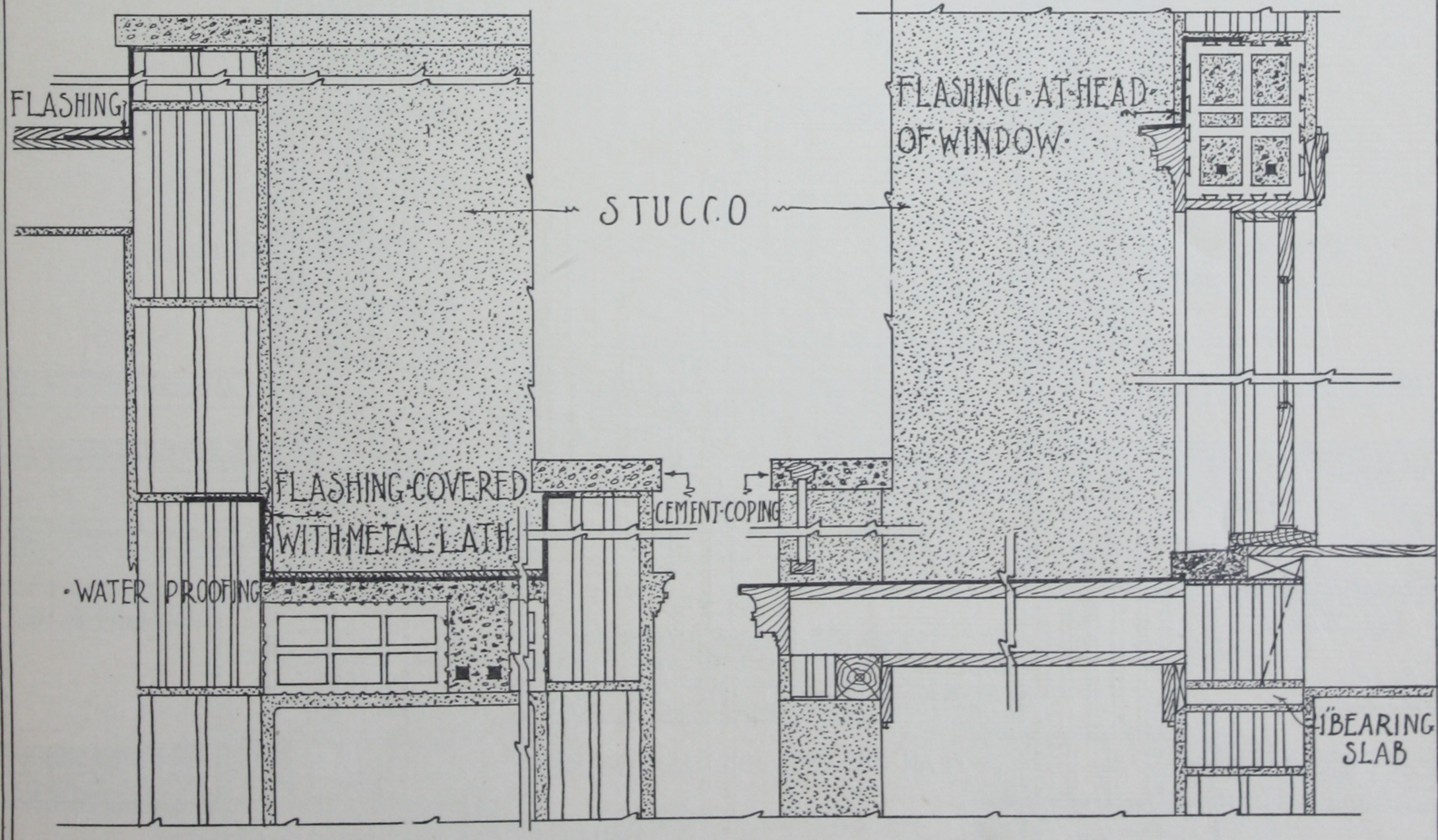


CORRECT METHOD

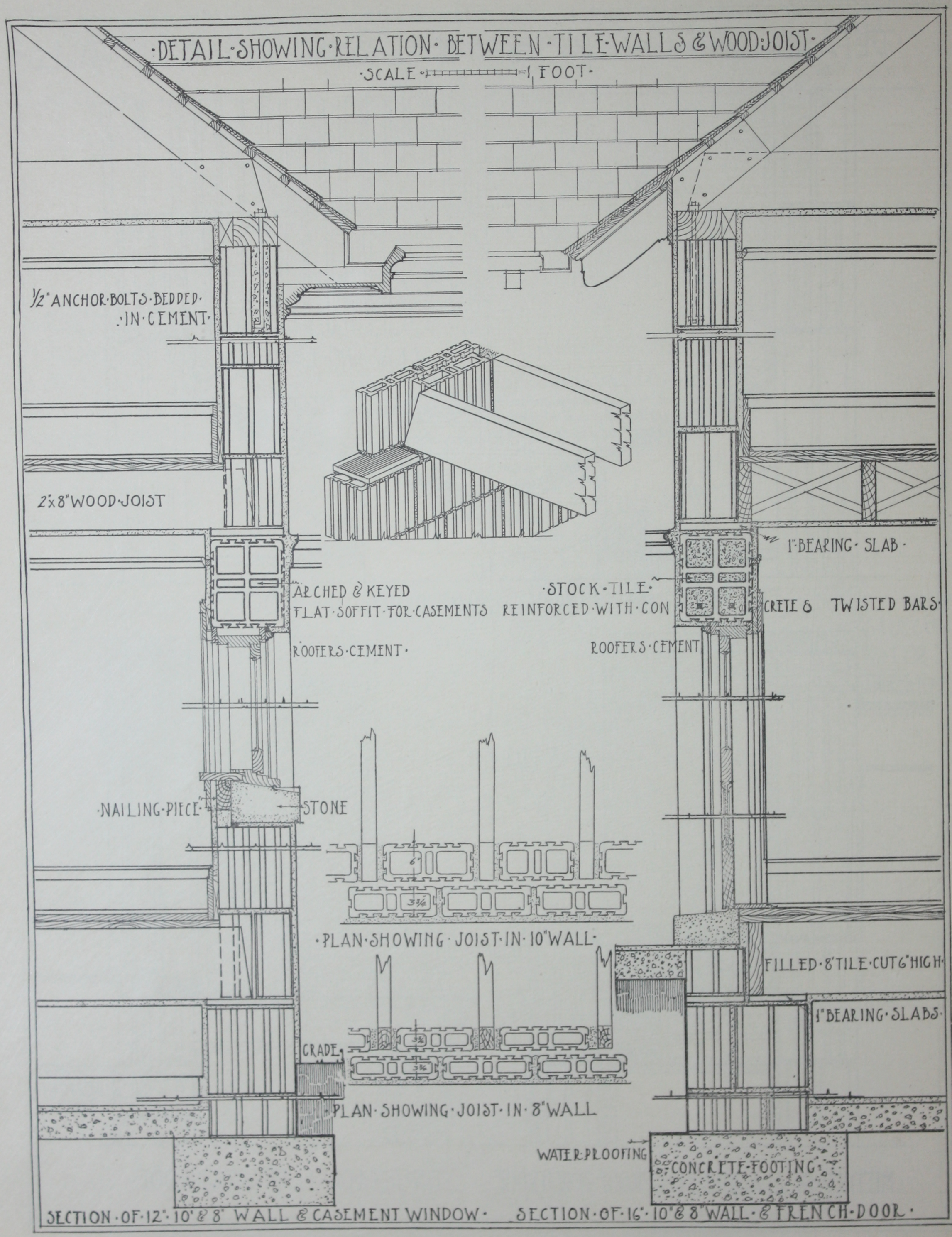
DETAILS SHOWING METHODS OF FLASHING NATCO TILE WALLS



FLASHING ON SLOPING WOOD PORCH ROOFS



METHOD OF FLASHING FIREPROOF PORCH ROOF TIN DECK ON FLAT WOOD ROOF


DETAIL SHOWING RELATION BETWEEN TILE WALLS & WOOD JOIST
SCALE 1 FOOT
½" ANCHOR BOLTS BEDDED IN CEMENT
2"x8" WOOD JOIST
ARCHED & KEYED
FLAT SOFFIT FOR CASEMENTS
ROOFERS CEMENT
NAILING PIECE
STONE
STOCK TILE
REINFORCED WITH CON
CRETE & TWISTED BARS
ROOFERS CEMENT
1" BEARING SLAB
6"
3⅜
PLAN SHOWING JOIST IN 10" WALL
GRADE
PLAN SHOWING JOIST IN 8" WALL
FILLED 8" TILE CUT 6" HIGH
1" BEARING SLABS
WATER PROOFING
CONCRETE FOOTING
SECTION OF 12" 10" & 8" WALL & CASEMENT WINDOW
SECTION OF 16" 10" & 8" WALL & FRENCH DOOR

DETAIL SHOWING RELATION BETWEEN TILE WALLS & TILE & CONCRETE FLOOR

SCALE — 12 INCHES

RAFTERS

4"X6" ROOF PLATE

TILE & CONCRETE ROOF

¾"X24" BOLT GROVTID 5-0C

SECTION THRO' GIRDER

⅓ SPAN — ⅓ SPAN — ⅓ SPAN

ELEVATION OF GIRDER

SLEEPERS - FILL

RABBETED ARCH LINTEL

STUCCO

ROOFERS CEMENT

STUCCO

ROOFERS CEMENT

RABBETED ARCH LINTEL

CALKING

PLASTER

ROOFERS CEMENT

AIR SPACE

CEMENT FLOOR & BASE

CEMENT FLOOR

REINFORCING ROD

PLAN

LOOKING UP AT CEILING

REINFORCING ROD

14 WALL USING 10"8"4" TILE

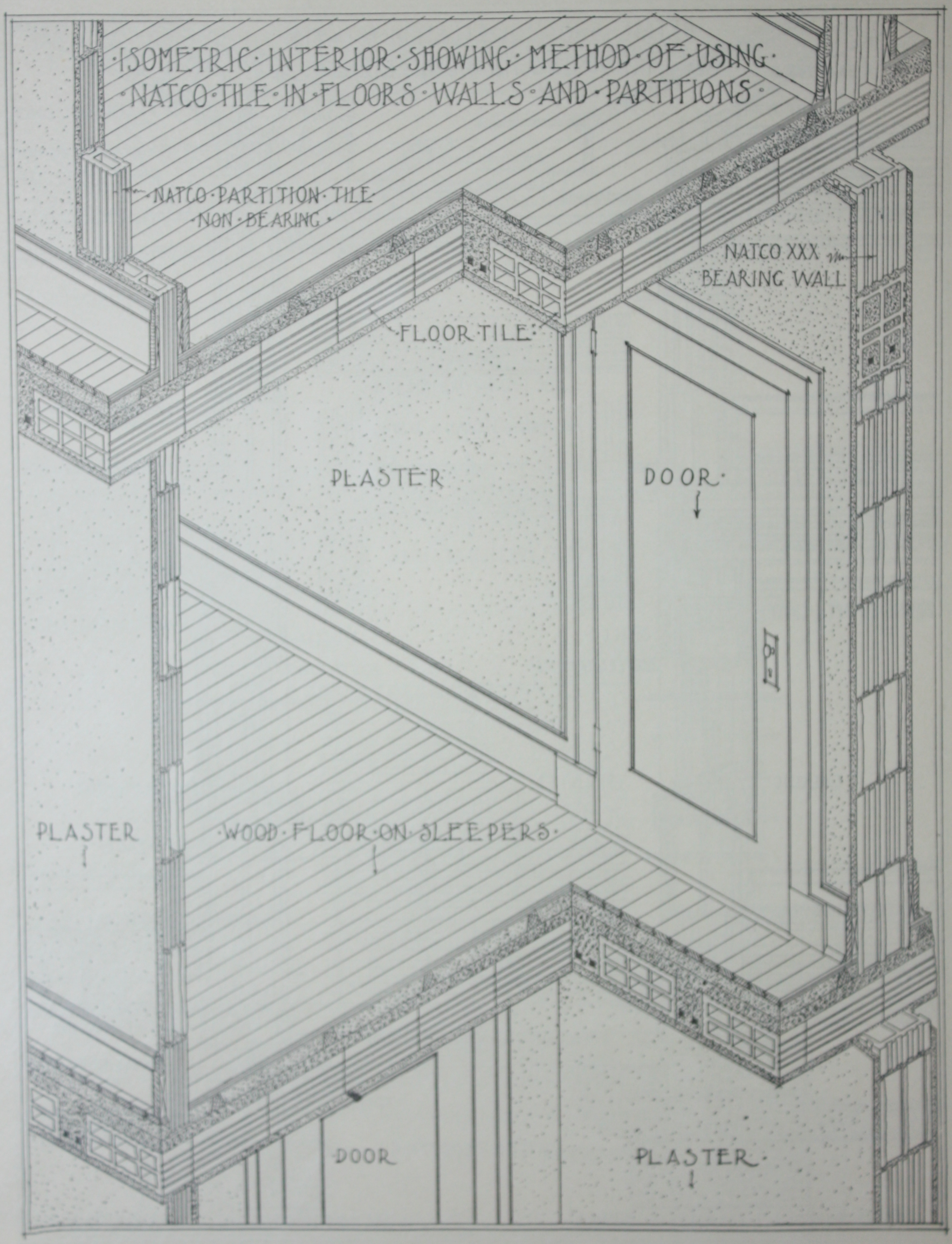
GRADE

GRADE

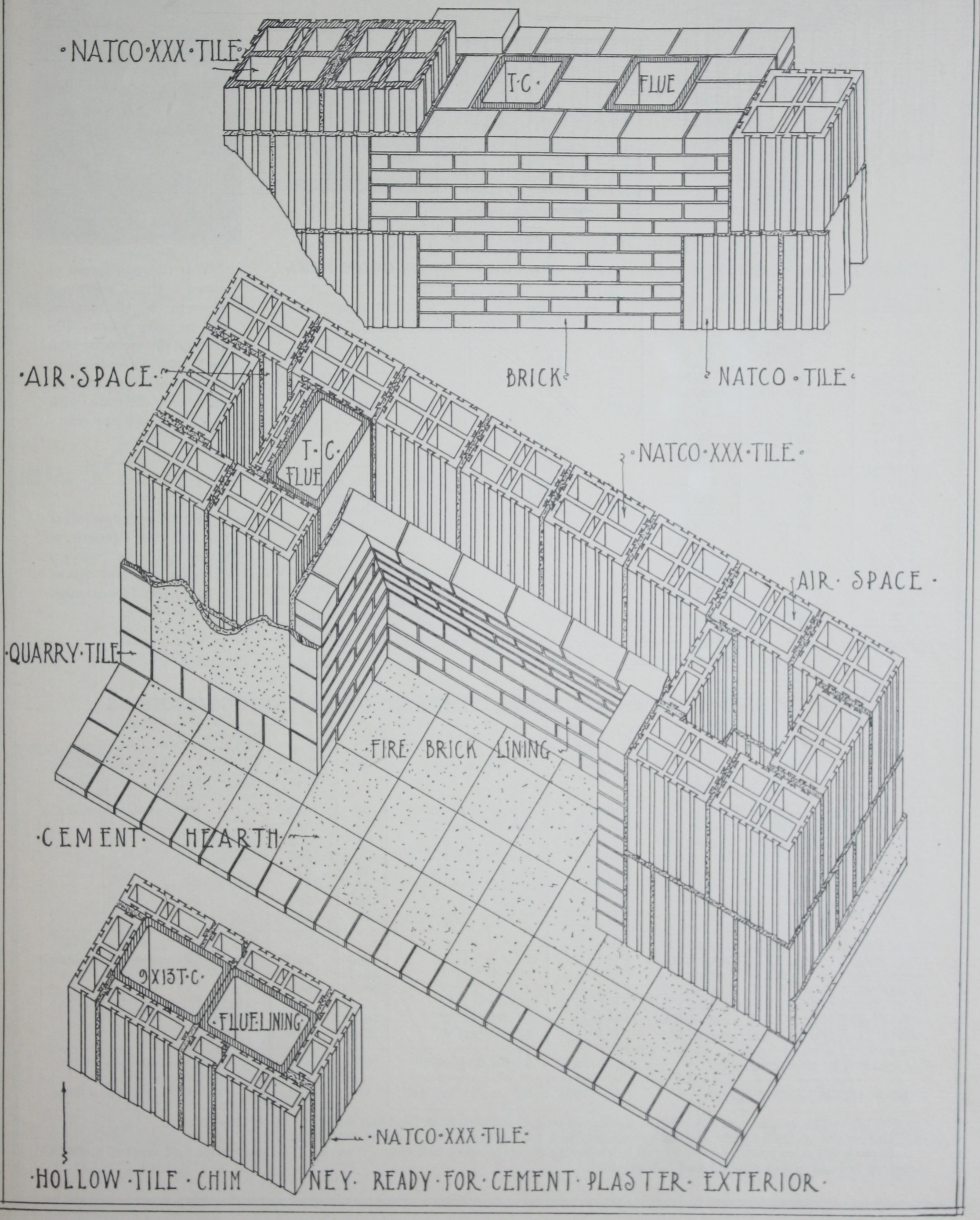
WATERPROOFING

SECTION THRO WALL PARALLEL TO BEAMS

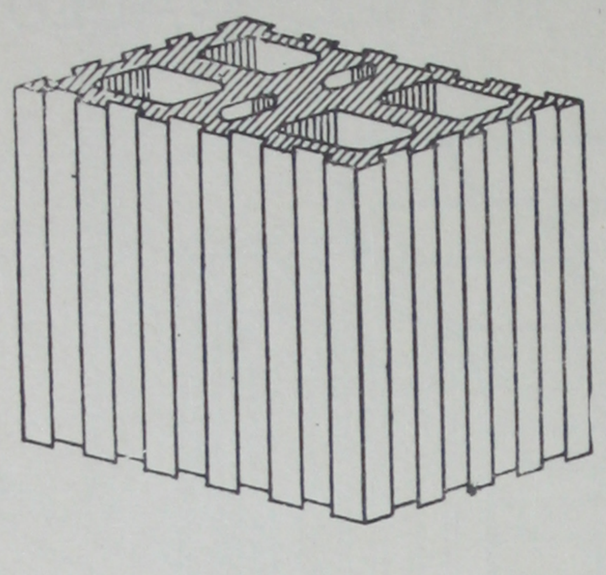
SECTION THRO WALL AT RIGHT ANGLES TO BEAMS

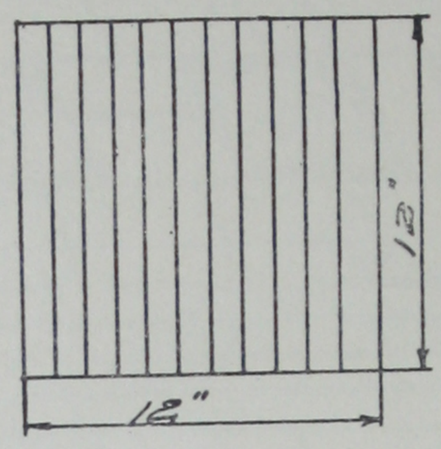

ISOMETRIC INTERIOR SHOWING METHOD OF USING NATCO TILE IN FLOORS WALLS AND PARTITIONS
NATCO PARTITION TILE NON BEARING
NATCO XXX BEARING WALL
FLOOR TILE
PLASTER
DOOR
PLASTER
WOOD FLOOR ON SLEEPERS
DOOR
PLASTER

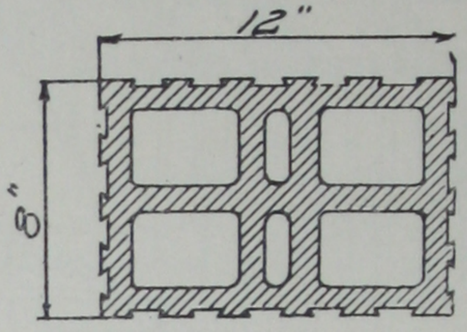
METHOD OF BONDING BRICK PIER OR CHIMNEY IN TILE WALLS

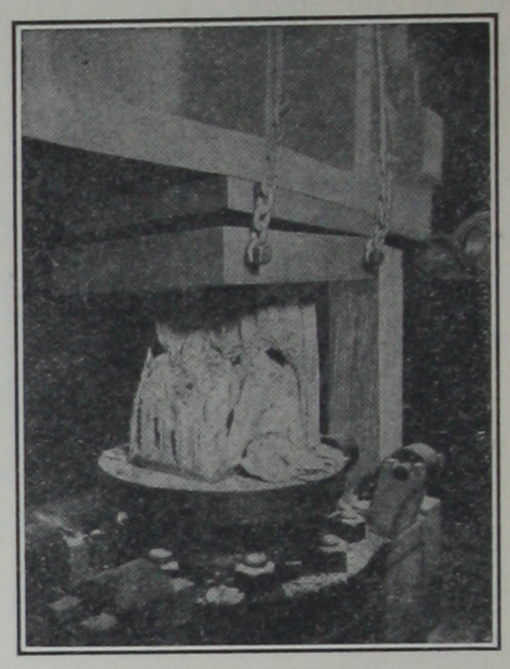


HOLLOW TILE CHIMNEY READY FOR CEMENT PLASTER EXTERIOR









TEST OF INDIVIDUAL NATCO XXX TILE

AREA IN COMPRESSION 45.56 SQ. IN. NET AREA OR 96 SQ. IN. GROSS AREA

Time P. M.	Gauge Reading in Tons 2000 Lbs.	Actual Load on Tile Lbs.	Actual Load in Lbs. per Sq. In. on Net Area of Tile in Compression	Remarks
	1.25	0	0	
3:09	5	7500	165	
3:26½	10	17500	384	
3:28½	20	37500	823	
3:30½	30	57500	1262	
3:32½	40	77500	1701	
3:34½	50	97500	2140	
3:39½	60	117500	2579	
3:44½	70	137500	3018	
3:47	75	147500	3238	Very Slight Sound
3:49½	80	157500	3457	No Sounds
3:52	85	167500	3677	No Sounds
3:54½	90	177500	3896	Very Slight Sound
3:57	95	187500	4116	Distinct Sound
3:59½	100	197500	4335	Slight Sounds
4:02	105	207500	4555	Continual Slight Sounds
4:04½	110	217500	4774	Continual Slight Sounds
4:07	115	227500	4994	Continual Cracking Sounds
4:09½	120	237500	5213	Failure by Crushing

Built May 6, 1914. Ends trued up with Portland Cement Mortar. Failed at 237,500 lbs. by crushing. Tested May 18, 1914

This tile was tested to prove the enormous strength of tile set on end to carry loads. Obviously the strength of a wall also depends upon the strength of the mortar used and the care with which the tile are set.

The table below gives the crushing strength of walls built of various kinds of tile and tested in different laboratories.

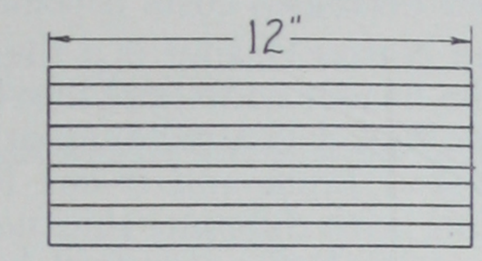
STRENGTH OF TILE WALLS—TESTS COMPILED FROM VARIOUS SOURCES

Remarks	Mortar Cement Sand Lime	Size of Wall	Age Days	Wall Gross Strength Lbs. per Sq. In.	Single Tile Gross Strength Lbs. per Sq. In.	Testing Laboratory
8"x12"x 8" Natco XXX–Test on End	1–3–0	8"x36½"x12'0"	26	1680		Robert W. Hunt & Co.
8"x12"x 8" Natco XXX–Test on End	1–3–0	8"x37 "x12'1"	25	1135		"
8"x12"x 8" Natco XXX–Test on End	1–3–0	8"x37 "x12'1"	47	1265		"
8"x12"x12" Natco XXX–Test on End	1–4–1	8"x36½"x12'2"	28	1500	2475	"
8"x12"x12" Natco XX–Test on End	1–3	8"x35 "x12'4"	28	570		"
8"x12"x12" Natco XX–Test on End	1–3	8"x36½"x12'6"	33	1220		"
8"x12"x12" Natco XX–Test on Side	1–3	8"x37 "x12'4"	28	280		"
8"x12"x12" Natco XX–Test on Side	1–3–1	8"x33 "x12'0"	99	330		"
Walls 4'0"x12'0". Mortar joints ⅜"						U. S. Bureau of Standards, Pittsburgh
12"x12"x12" Natco XXX–Test on End	1–3–¼	12"x4'0"x12'0"	28–32	934	2855*	"
6"x12"x12" Natco XXX Test on End	1–3–¼	6"x4'0"x12'0"	28–32	1020	4000*	"
8"x12"x12" Natco XXX–Test on End	1–3–¼	8"x4'0"x12'0"	28–32	1040	2310*	"
12"x12"x12" Natco XXX–Test on End	1–3–¼	12"x4'0"x12'0"	28–32	940	1675†	"
6"x12"x12" Natco XXX–Test on End	1–3–¼	6"x4'0"x12'0"	28–32	713	1900†	"
6"x12"x12" Natco XXX–Test on Side	1–3–¼	6"x4'0"x12'0"	28–32	385	585†	"
Toronto brick—average quality	1–3–25%	8½"x 8½"x9'0"	105	550		Toronto University
Natco 8"x5"x12" Bakup	1–3–10%	8" x 5'4"x 9'10"	18	290		U. S. Bureau of Std.

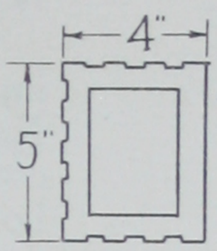
NOTE:—The results given for * tile are the averages of three tests for both walls and individual tile.
The results given for † tile are the averages of two tests of walls and those of individual tile.
These walls were built by experienced brick layers accustomed to this class of work. The proportions of mortar materials are given in bulk measurements and not weight.

DETAIL OF NATCO BAKUP TILE WITH BRICK VENEER

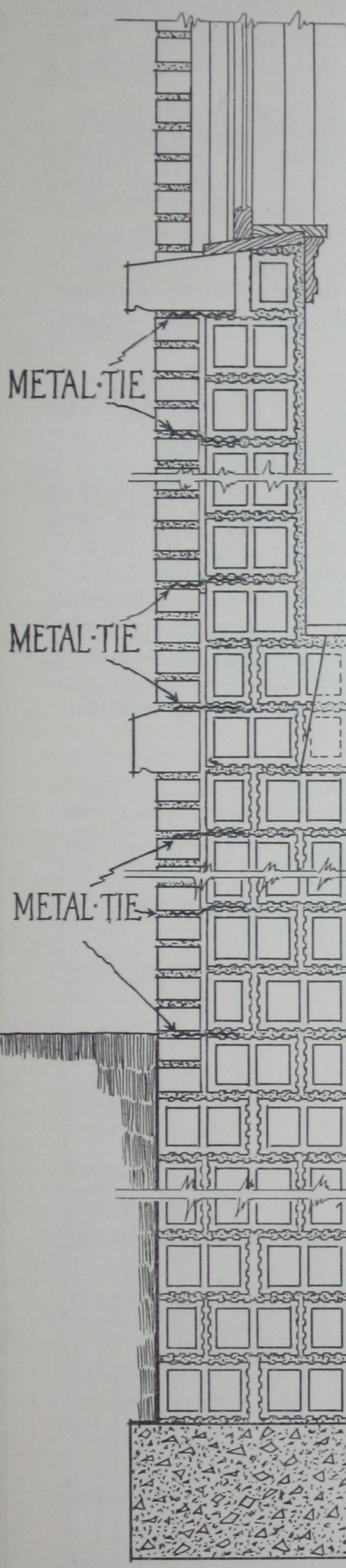
NATCO BAKUP TILE ARE MADE IN TWO SIZES 5"X8"X12" AND 5"X4"X12" CORNER TILE FURNISHED FOR BOTH SIZES

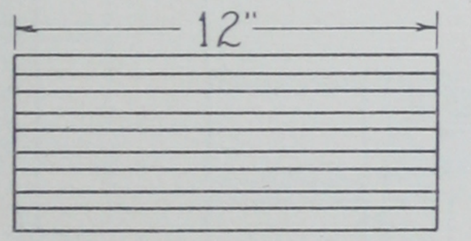


SIDE VIEW

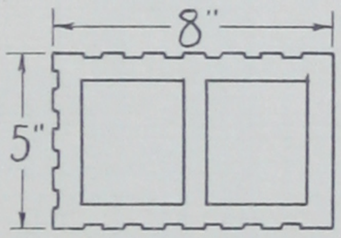


END VIEW



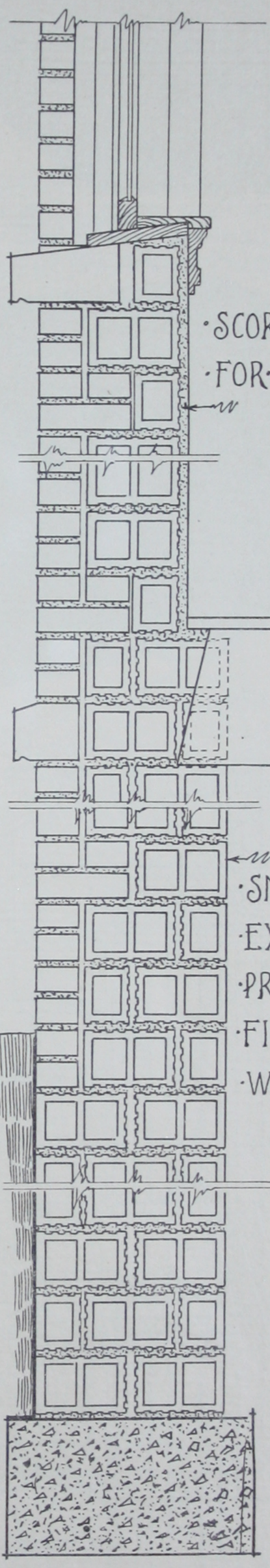


SIDE VIEW



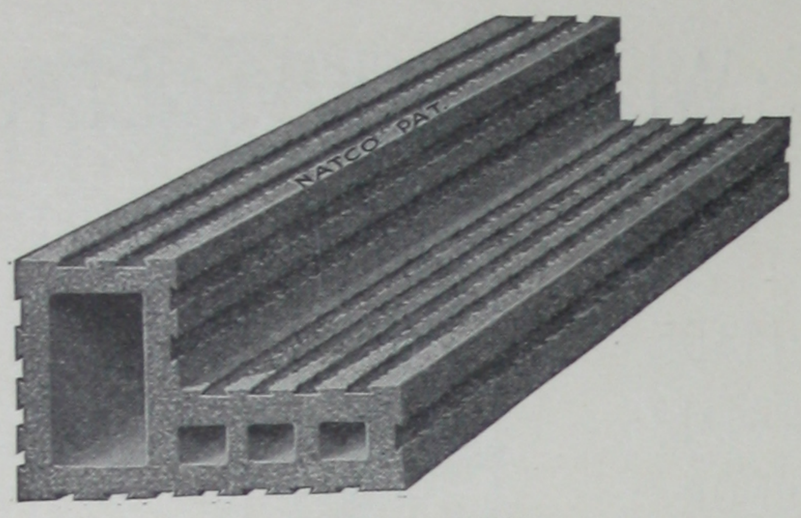
END VIEW

ALL NATCO BAKUP TILE ARE SCORED 3 SIDES AND SMOOTH ON ONE 5"X12" FACE SO THAT A SMOOTH WALL INSIDE OR OUT MAY BE HAD IF DESIRED

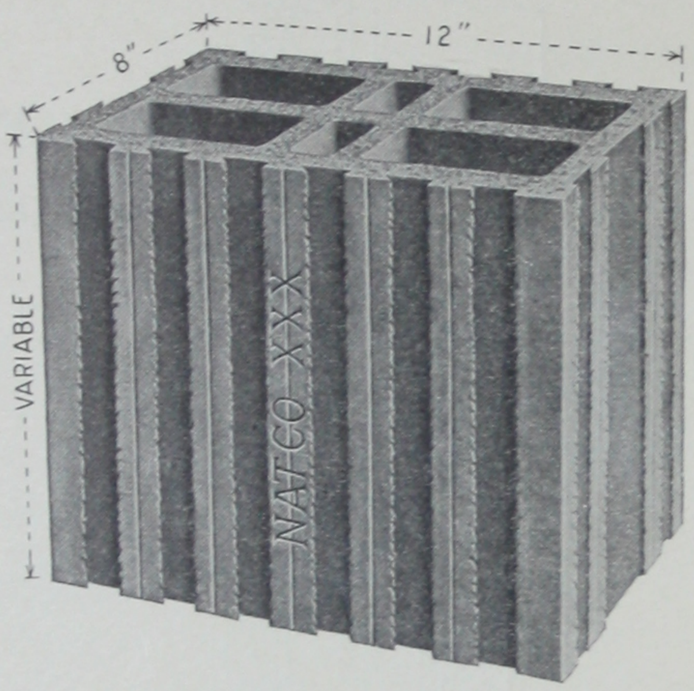


SECTION OF WALL SHOWING BRICK VENEER SECURED WITH METAL TIES

SECTION OF WALL SHOWING BRICK VENEER BONDED WITH BRICK HEADERS



Natco Header Tile



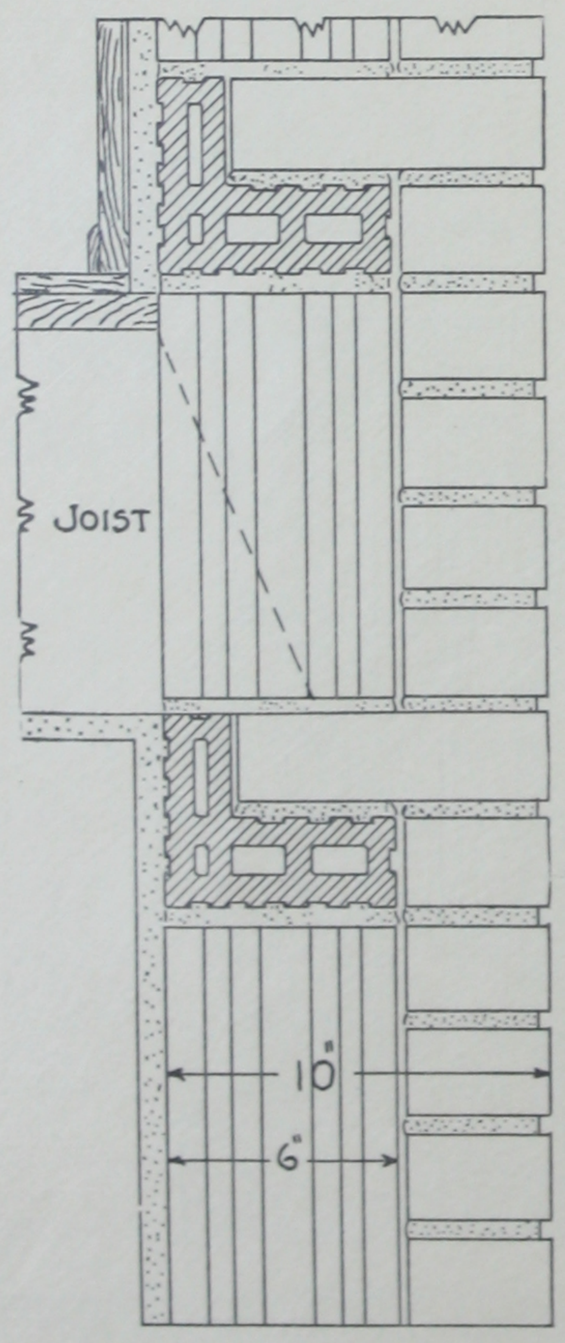
Natco Backer Tile

Natco Header Backer Tile

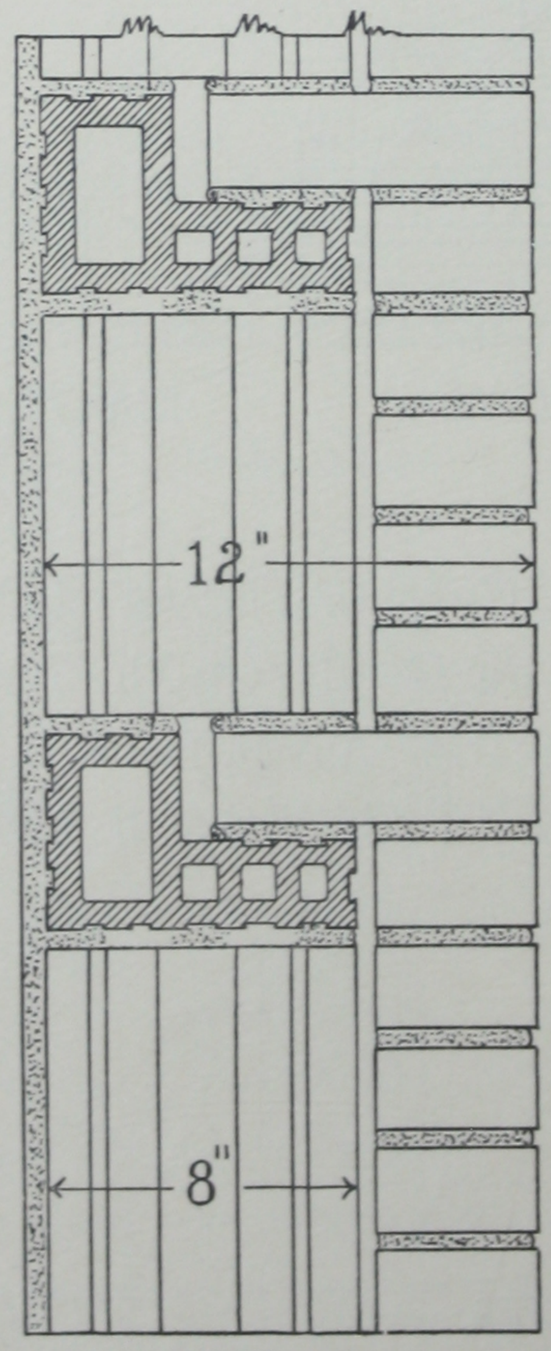
WALLS of Natco Header Backer Tile in combination with brick or stone, are mechanically bonded, light in weight, substantial and permanent. Their use in commercial and industrial buildings has become a standard construction.

For enclosure walls in steel or reinforced concrete skeleton buildings, Natco Header Backer walls are the ideal in point of economy. The facing of face brick, stone, or other material, and the backing of Natco Header Backer Tile work in unison to carry the load. No cutting or use of slabs is required. A saving of 25 per cent in labor and mortar is effected in the walls themselves. A lighter structural frame, made possible by a 25 per cent reduction in dead weight, further decreases costs considerably.

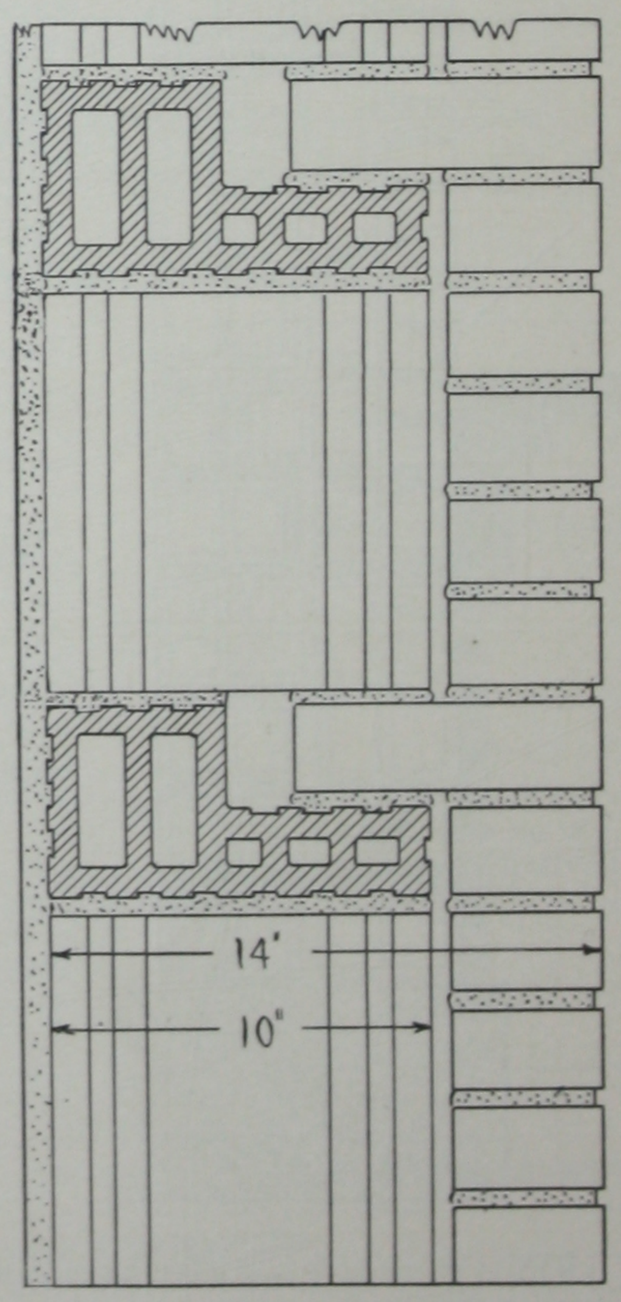
The Natco Header is a tile designed especially for bonding the header courses of face brick to the tile backing. The Natco Backer is a rectangular tile for backing the stretcher courses of brick and is cut to various heights for proper bonding with different thicknesses of face brick and mortar joints. With the standard brick of 2¼ in. thickness, laid up with ½ in. bed joints, a Backer tile 10½ in. high is required and this is the most common usage. When bonded the Natco Header Backer way, full bearing value for the entire thickness of the wall is allowed. Where metal wall ties are used instead of a header bond, the brick facing acts only as a veneer, so cannot be figured to carry any load, and in time is likely to crack and fall away from the backing material.



Typical section of 10-inch wall showing joist bearing



Typical Section of 12-inch wall



Typical section of 14-inch wall

By the use of Natco Header Backer construction, a dry insulated wall is assured as there are no mortar joints extending through the wall. Thus cold, heat and moisture cannot penetrate. The interior tile surface is scored and forms an ideal base for plastering.

Below are sections of 10-inch, 12-inch, 14-inch, and 16-inch walls. You can just as readily build 20-inch, 24-inch, or thicker walls, with the use of additional tile.

One 8 x 5 x 12 in. Natco Header Tile and one 8 x 12 x 10½ in. Natco Backer Tile, including ½ in. bed and vertical joints, lay up 1.43 sq. ft. of wall surface, or conversely, there are required 700 Headers and 700 Backers to lay up 1000 sq. ft. of wall surface.

Special 8" Wall Construction

For residences we can supply 4x12x10½ Tile to be faced with 4 inches of brick and when bonded with headers every fifth course, makes a satisfactory 8 in. masonry wall. Details will be furnished on application.

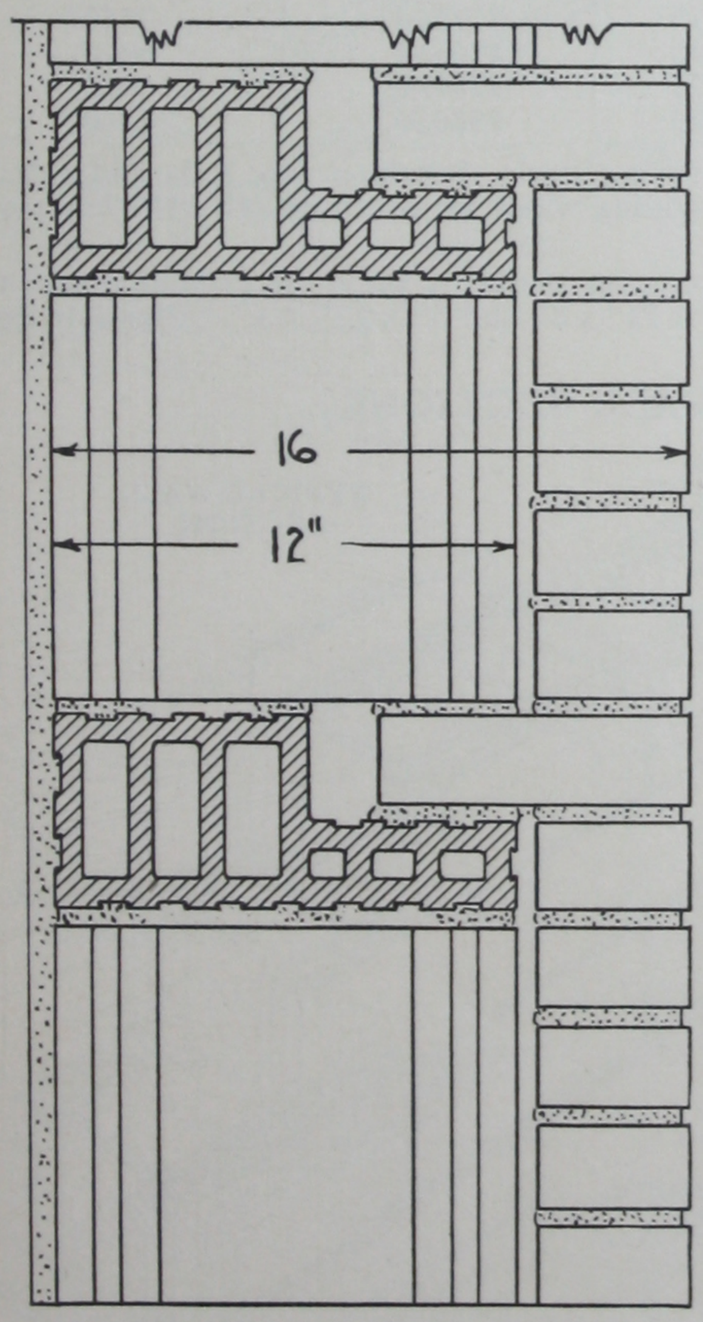
Our Estimating Department is at your service at all times. If you will write us, we shall be glad to figure on any plans or blue prints you send us and shall give you the cost of the quantities of Natco Hollow Tile which you will need for any type of building delivered at your nearest railroad station.

Advantages

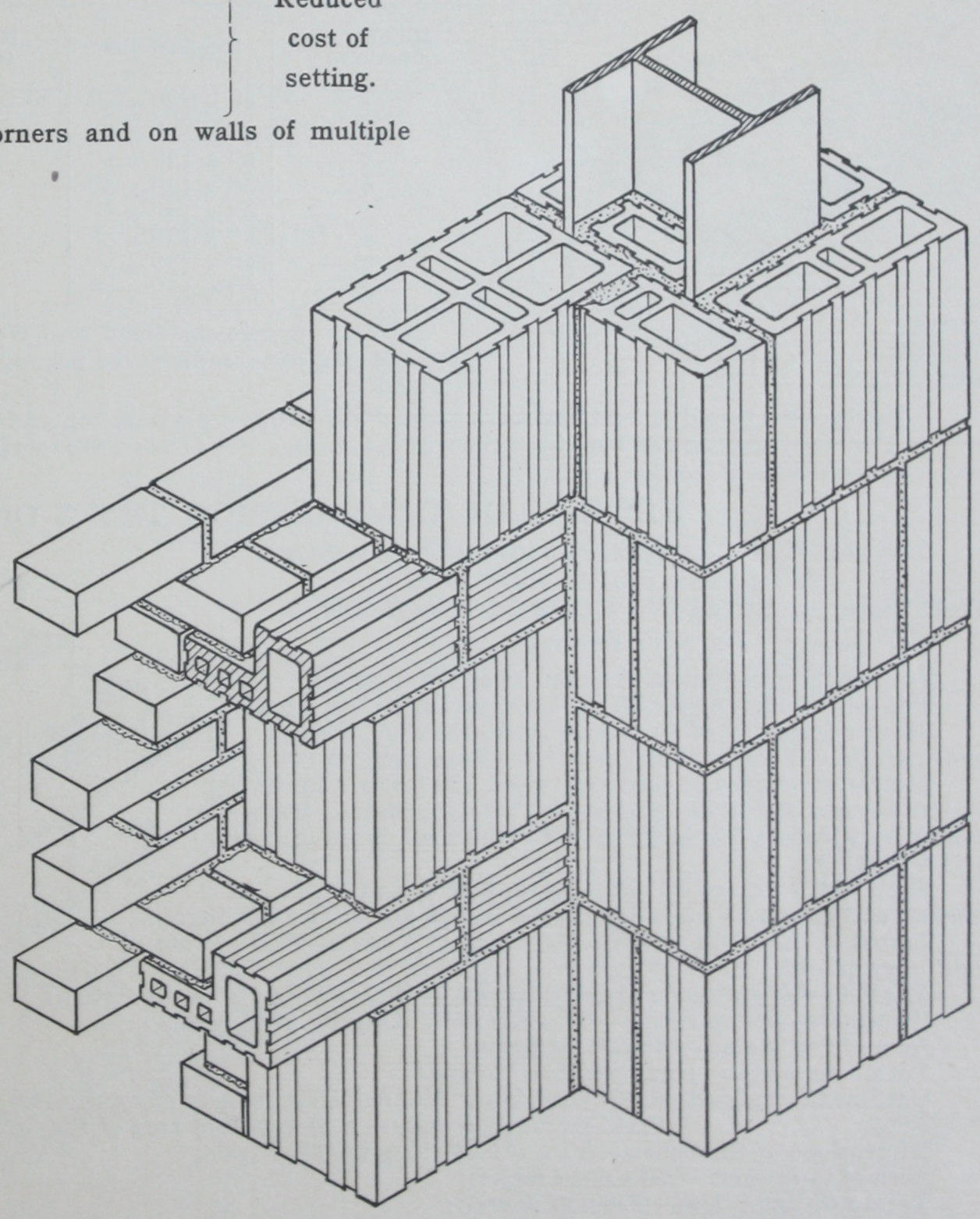
1. Ability to work to any story height without cutting or use of slabs.
2. Full bearing for floor joists.
3. Decreased dead loads compared to brick backing.
4. Made in suitable heights to afford proper bonding.
5. No through mortar joints—therefore no moisture penetration, eliminating necessity of furring.
6. Minimum number of units to handle.
7. Saving in mortar.
8. Rapidity of construction.

} Reduced cost of setting.

9. Simplicity of construction at jambs and corners and on walls of multiple thickness.



Typical section of 16-inch wall



Bonding of Column Covering and wall

THE STANDARD HEIGHT BACKER IS 10½" AND THE HEADER 5", BUT AS NOTED ABOVE THIS CAN BE VARIABLE

NATCO DOUBLE-SHELL TILE

GENERAL DATA AND LOAD TESTS

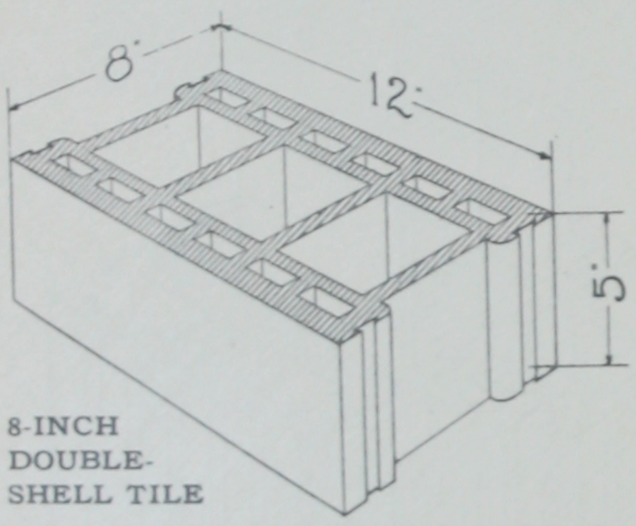
As indicated in the name of this improved NATCO product, the interior and exterior "bed" or horizontal mortar joints are spread on double shells of sufficient width to insure a well bonded wall of maximum strength. The "head" or vertical joints are spread on the edges of the ends of each tile so as to leave an air space in these joints. The recess or moisture-stop at both ends of the regular wall-tile further assures the obtaining of this air space. No attempt should be made to spread mortar on the cross webs. Strict adherence to these details will avoid through mortar joints which are almost invariably conductors of moisture and cold, a frequent source of trouble with other types of construction.

The general instructions for mortar, laying, etc., given for NATCO XXX apply with equal force to the handling of all NATCO Hollow Tile. The following, however, are points that should be kept in mind when designing or erecting with this face-tile.

1. SIZES, 6" x 12" x 5"—for walls 6 inches thick.
   8" x 12" x 5"—for walls 8 inches thick.
2. TYPES, GLAZED—One scratched face 12" x 5" and one smooth face 12" x 5", giving an exterior finish similar to a rough face brick and a smooth impervious interior.
   UNGLAZED—Two scratched faces 12" x 5", giving a choice of two faces for an exterior finished surface similar to a rough face brick and an interior scratched surface rough enough for the application of ordinary plaster directly to the hollow tile surface.
3. UNITS. In designing buildings or when laying out foundation or other walls, it should be borne in mind that this face-tile is made in 12-inch and 5¾-inch lengths, and the length of the walls from corner to corner and the width of all openings, should conform to these full and half units allowing ⅜ inch for mortar joints. The height of walls and of all openings should be fixed in multiples of 5 inches allowing ⅜ inch for each "bed" mortar joint.
4. The shapes shown on the page opposite and on the following pages are our standard, therefore designers should avoid any "specials" not shown thereon. The preparation of a new die takes considerable time and money, and involves the manufacture of an untried shape. These "standards" have been adopted after long experience and investigation and should meet every building requirement. The advice of our building experts is always at the disposal of the architect, designer, and contractor.
5. Note carefully the location of factories at which the several types of face tile are manufactured; this information is found at the top of each page just below the title.

COMPRESSION TESTS OF SINGLE UNITS OF DOUBLE SHELL TILE

Conducted by Carnegie Institute of Technology, Pittsburgh, Pa., July, 1918



8-INCH DOUBLE-SHELL TILE

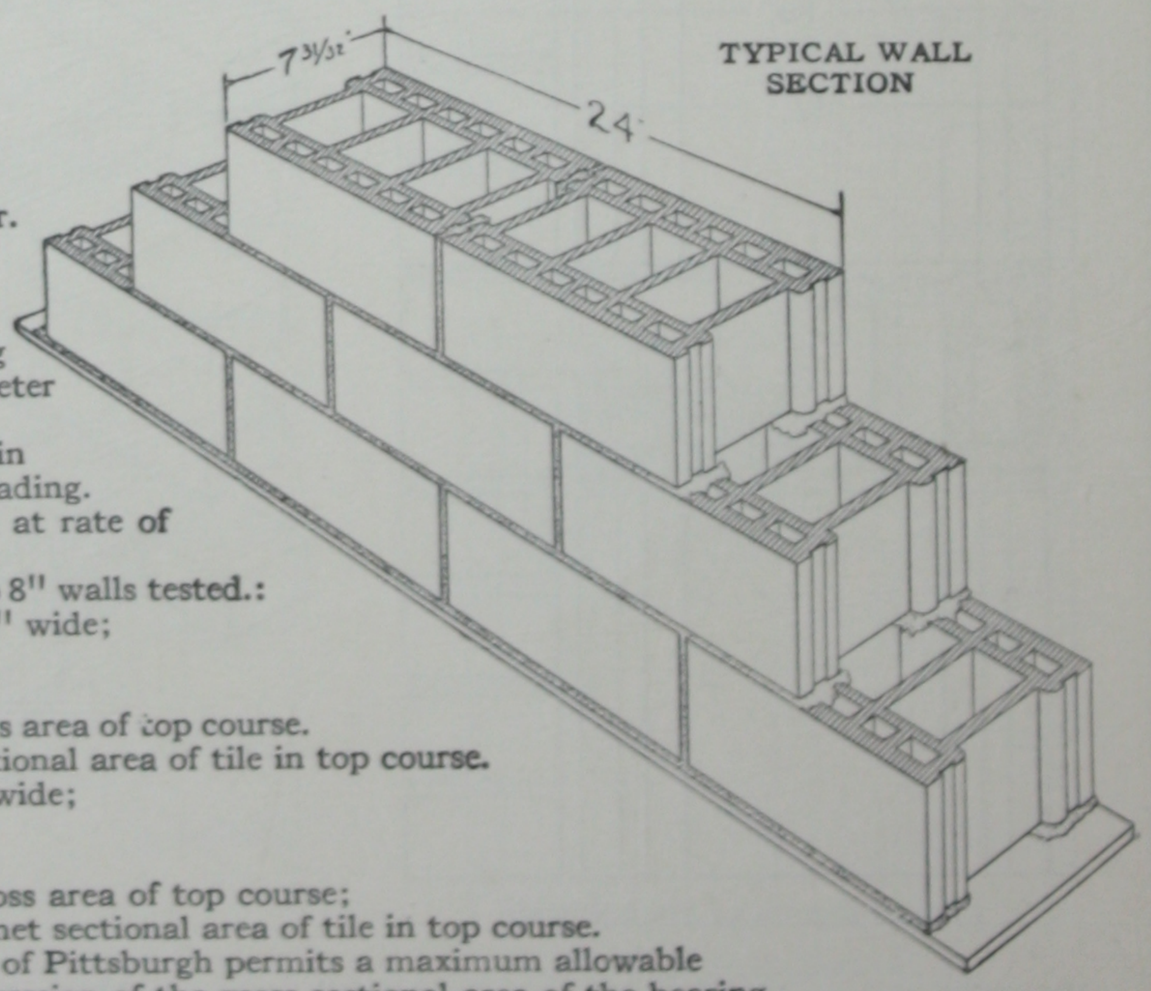
Number of Specimen	Nominal Size	Net Area (Sq. In.)	Maximum Load	
			Total (Lbs.)	Units (Lbs per Sq. In.)
1	8" x 12" x 5"	44.25	299450	6770
2	8" x 12" x 5"	44.25	258580	5840
3	8" x 12" x 5"	44.25	285280	6450
4	6" x 12" x 5"	39.75	238000	5990
5	6" x 12" x 5"	39.75	311650	7840
6	6" x 12" x 5'	39.75	270510	6810
7	8" x 12" x 5"	44.25	224760	5080
8	6" x 12" x 5"	39.75	252050	6340

NOTE:—Specimens No. 7 and No. 8 were glazed. Specimen No. 7 showed a detail failure at one end due likely to improper bedding which no doubt explains the low result obtained.

All tile were tested on end and were bedded in plaster of paris on top and bottom, the plaster of paris cap extending over the webs so that the full cross-section of the tile was in bearing. The sizes tested were 8" x 12" x 5" and 6" x 12" x 5". The unit loads were based on the *net area*.

RESULTS OF COMPRESSION TESTS ON WALL SECTIONS

Conducted by Carnegie Institute of Technology, Pittsburgh, Pa., Aug. 27, 1918.
Tests made for BUILDING CODE COMMISSION, City of Pittsburgh



TYPICAL WALL SECTION

Four walls were built and tested at age of 28 days.

Tile laid on end, as shown, by an experienced bricklayer.

Mortar joints ⅜ of an inch, 1 part cement, 1/10 part hydrated lime, 2 parts sharp sand—by loose volume.

Mortar specimens 28 days old tested 358 lbs. per sq. in. in tension and 2,900 lbs. per sq. in. in compression; being respectively standard briquettes and cylinders 2 in. in diameter and 4 in. high.

Each wall built on ½" steel plate; first course bedded in mortar, and plaster of paris cap placed on top just before loading.

Tested in 500,000-lb. Olsen Machine; all loads applied at rate of 0.25" per minute.

The following are average results for two 6" walls and two 8" walls tested.:

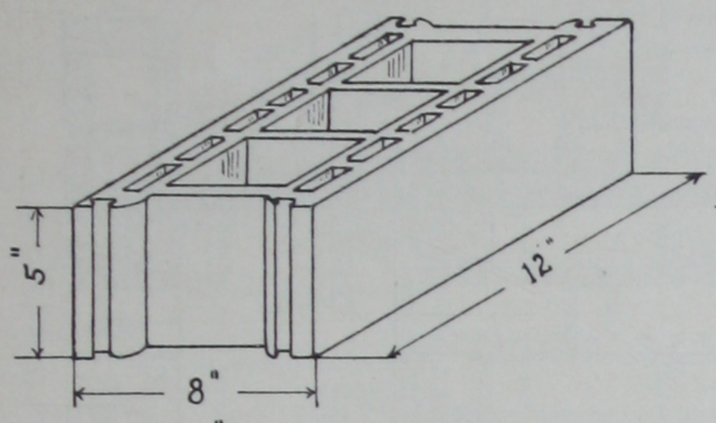
Dimensions of top course—6" wall; 24½" long by 5 15/16" wide;
Area of top course—145 square inches;
Total maximum load—202,520 pounds;
Unit maximum load—1,400 pounds per square inch gross area of top course.
2,548 pounds per square inch sectional area of tile in top course.

Dimensions of top course—8" wall: 24" long by 7 31/32" wide;
Area of top course—189 square inches;
Total maximum load—206,600 pounds;
Unit maximum load—1,090 pounds per square inch gross area of top course;
2,334 pounds per square inch of net sectional area of tile in top course.

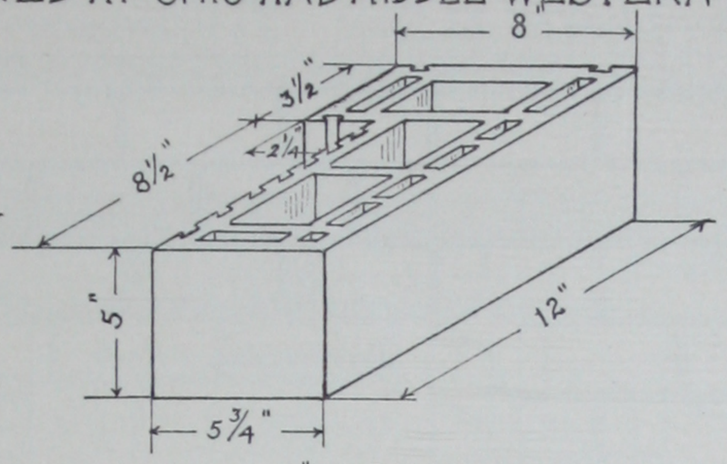
Based on these tests the present Ordinance of the City of Pittsburgh permits a maximum allowable unit working stress of 150 pounds per square inch in compression of the gross sectional area of the bearing. walls in which the tile is set with cells vertical in the wall.

DETAILS OF SHAPES OF 6" AND 8" NATCO DOUBLE SHELL TILE

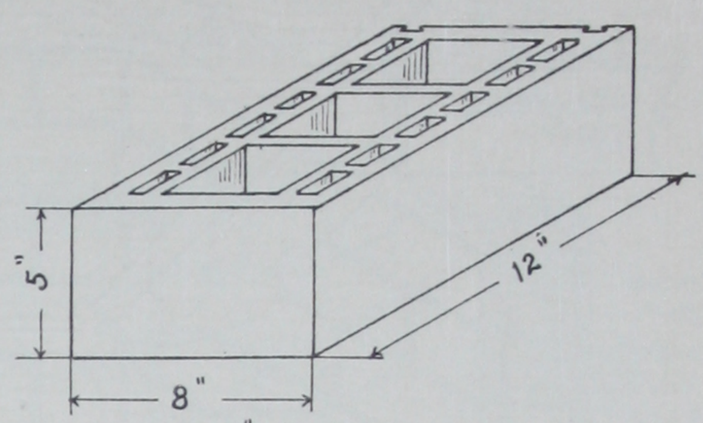
MANUFACTURED AT OHIO AND MIDDLE-WESTERN FACTORIES



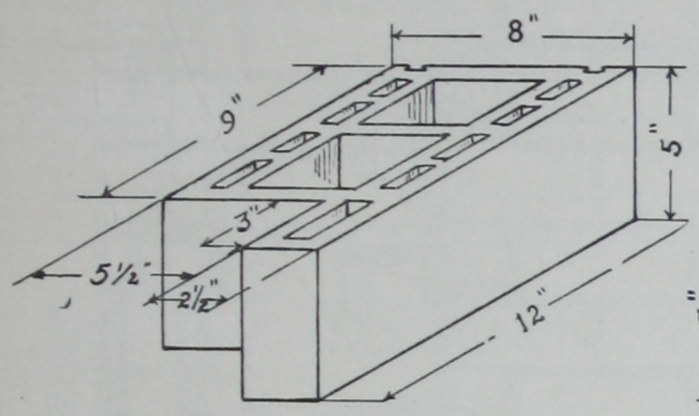
8" WALL TILE



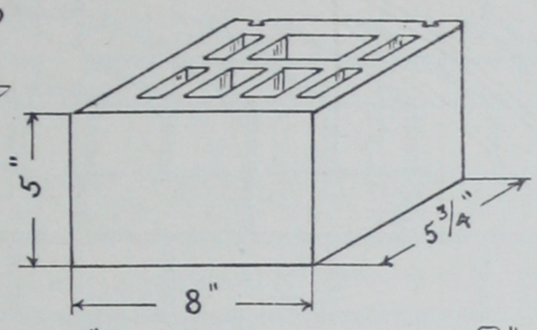
8" CORNER



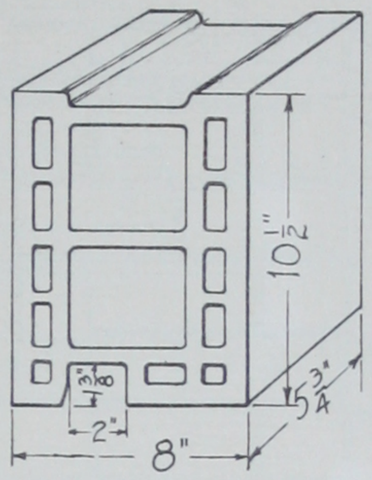
8" CLOSURE



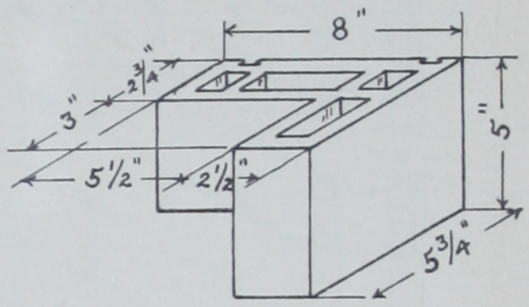
8" JAMB TILE



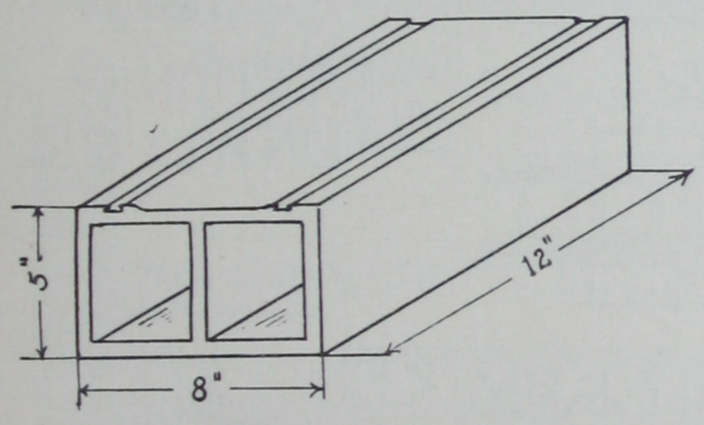
8" HALF CLOSURE



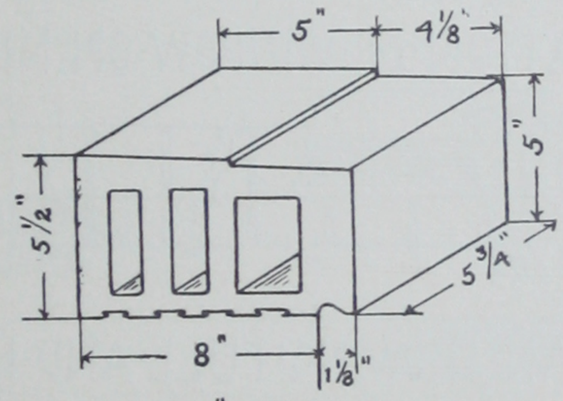
8" SOLDIER LINTEL



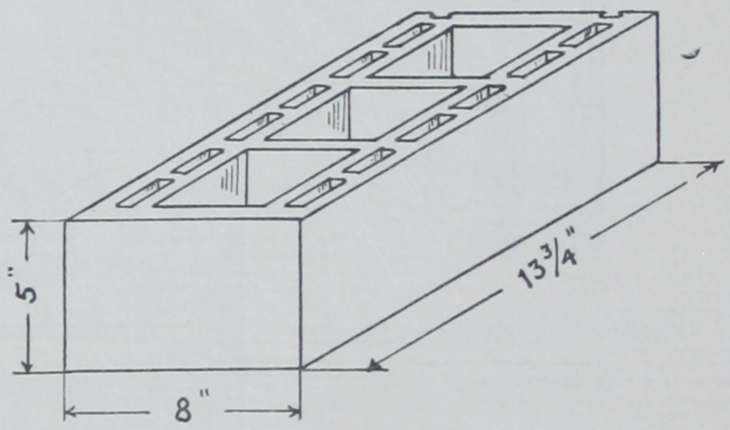
8" HALF JAMB



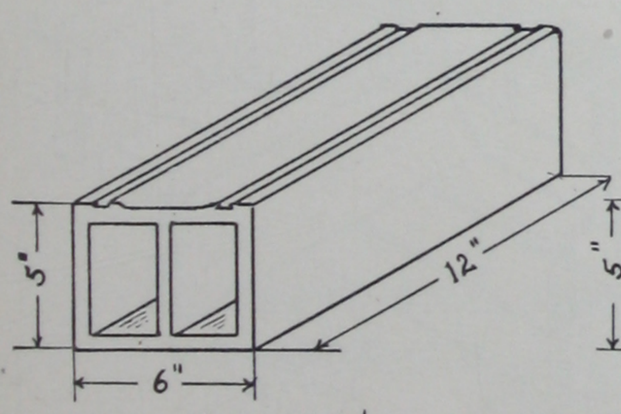
8" LINTEL



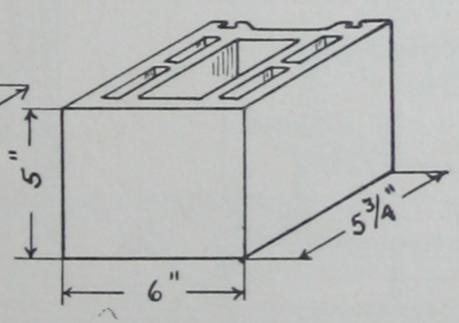
8" SILL



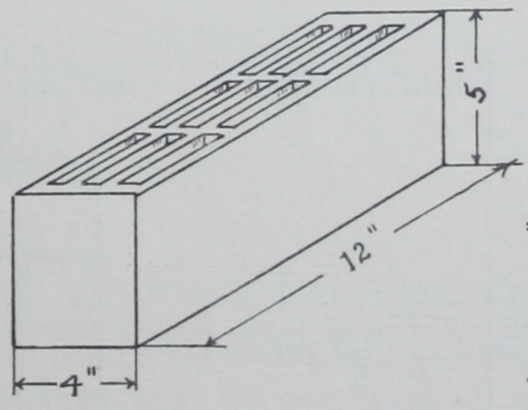
8" INSIDE CORNER



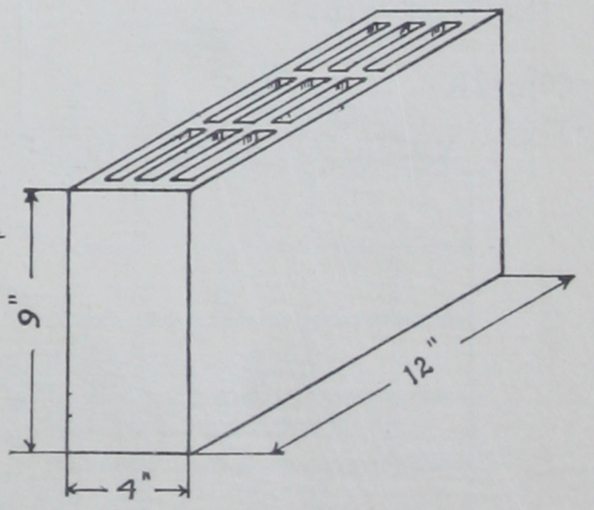
6" LINTEL



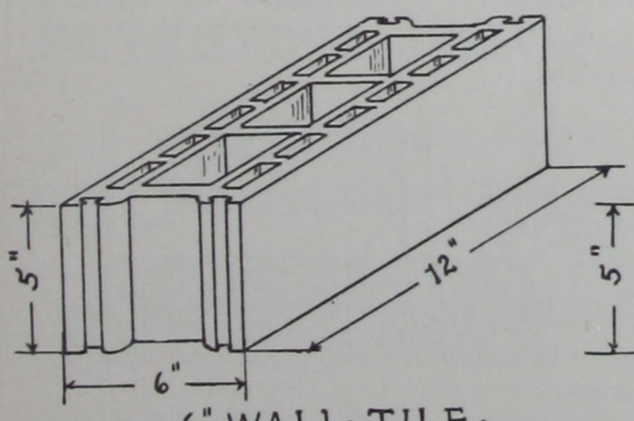
6" HALF CLOSURE



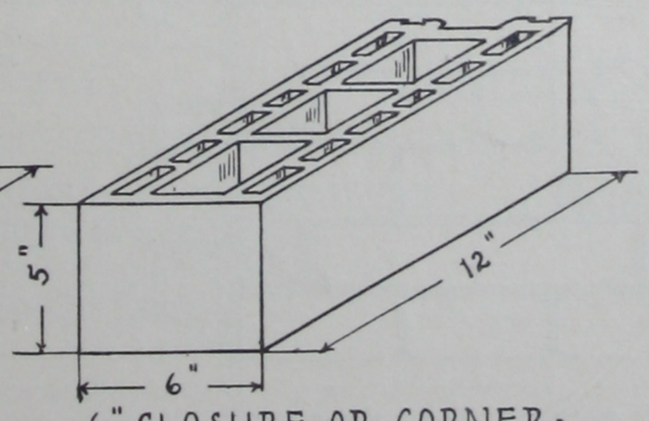
4" JOIST CLOSURE



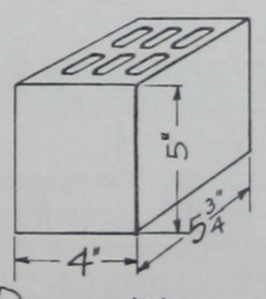
4" JOIST FILLER



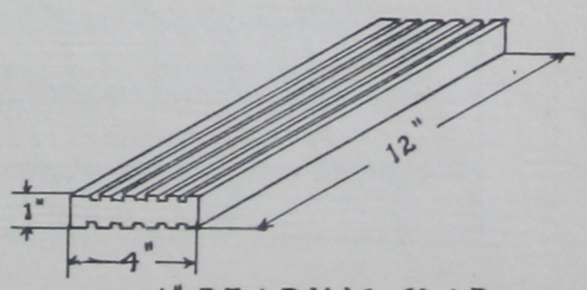
6" WALL TILE



6" CLOSURE OR CORNER



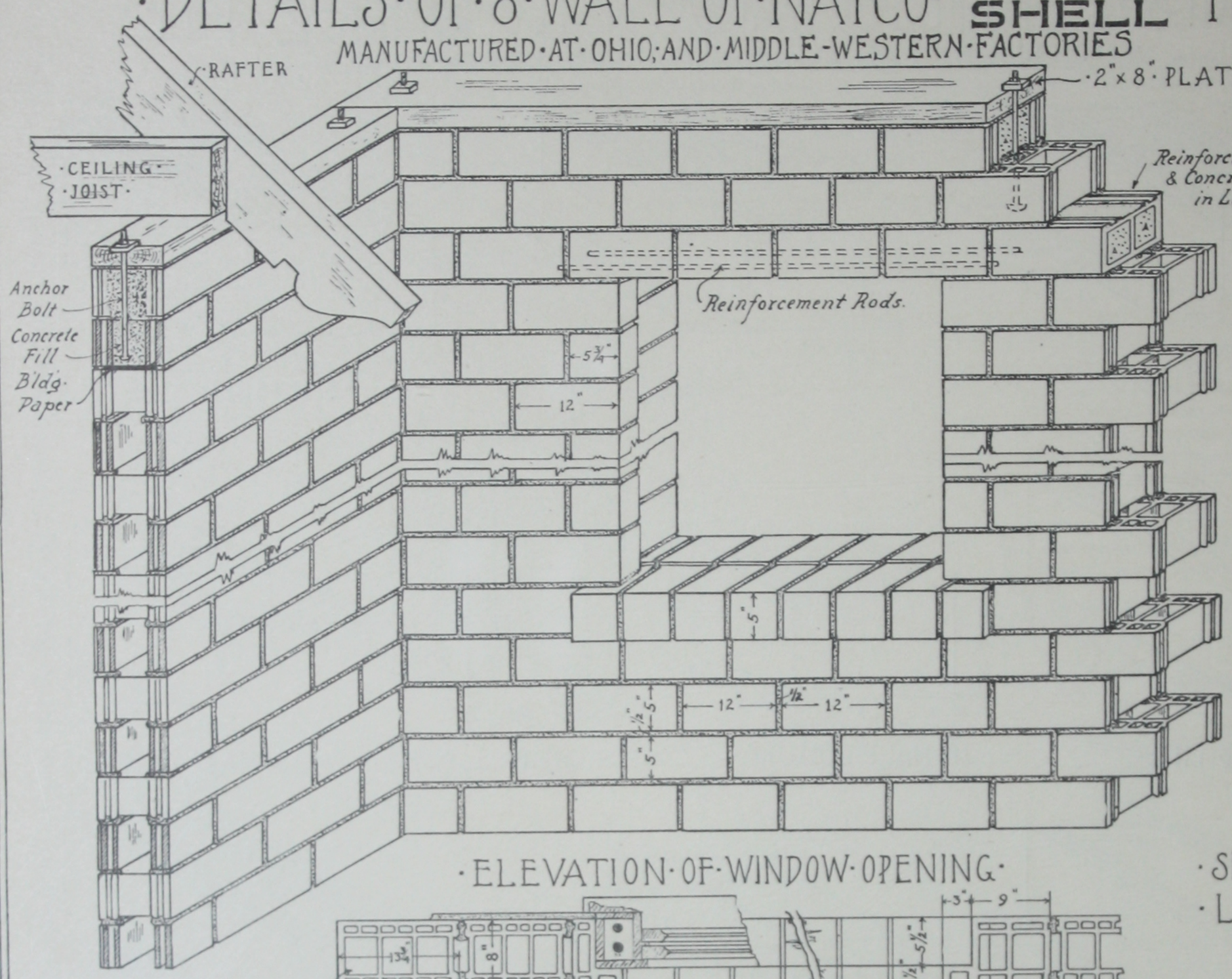
PILASTER



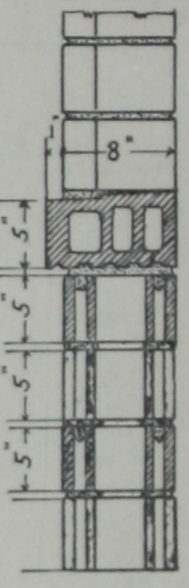
1" BEARING SLAB

DETAILS OF 8" WALL OF NATCO DOUBLE SHELL TILE

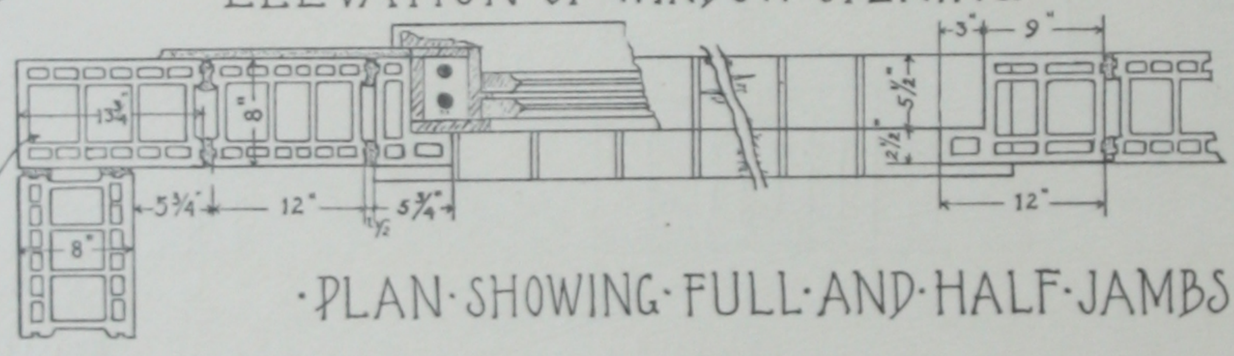
MANUFACTURED AT OHIO AND MIDDLE-WESTERN FACTORIES



ELEVATION OF WINDOW OPENING

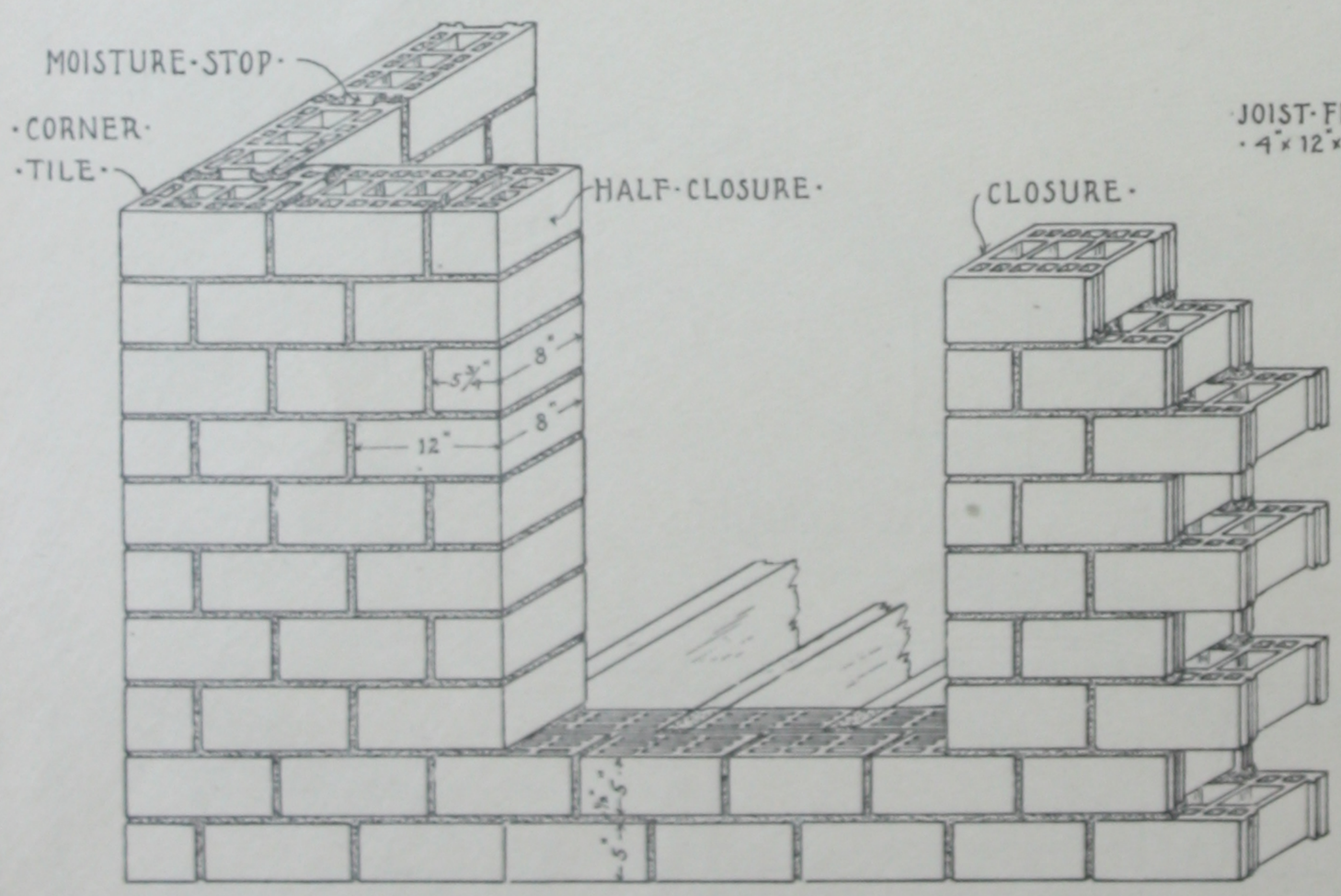


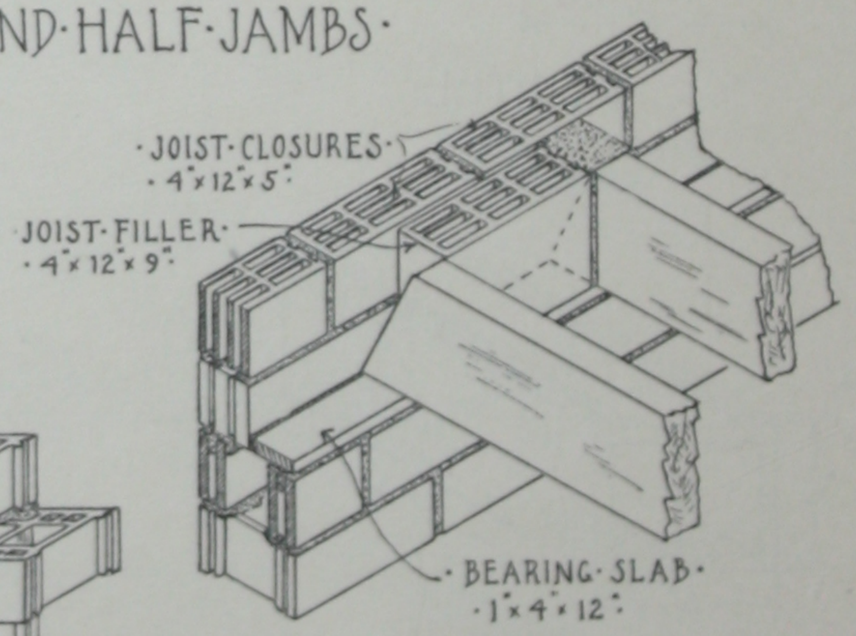
SECTION OF LINTEL & SILL



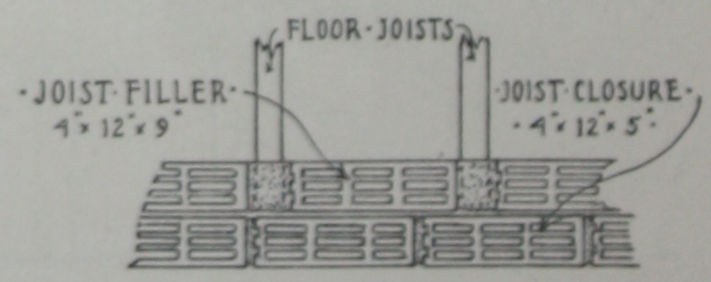
INSIDE CORNER TILE
8" x 13¾" x 5"

PLAN SHOWING FULL AND HALF JAMBS





ISOMETRIC VIEW OF JOIST BEARING CONSTRUCTION



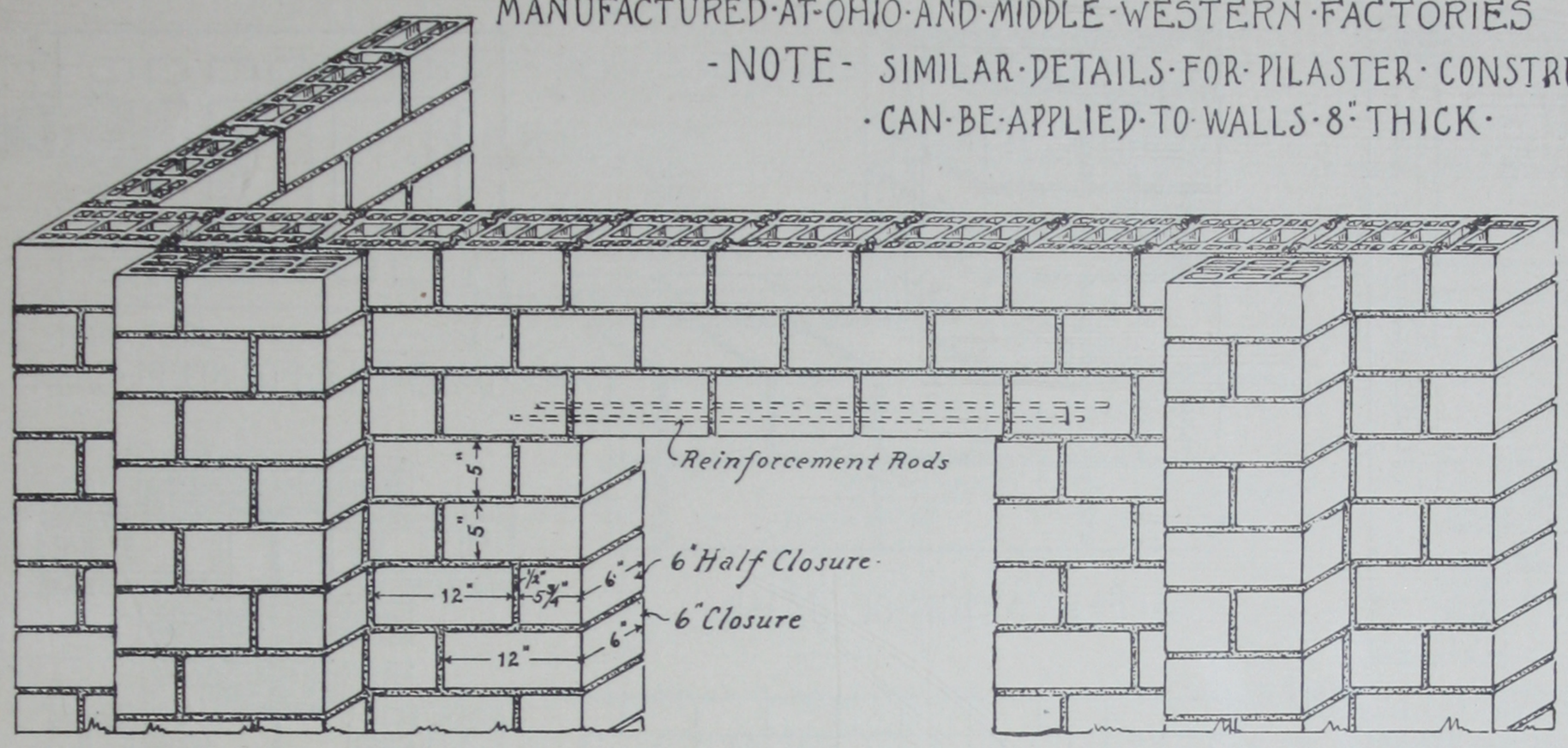
ELEVATION OF DOOR OPENING AND EXTERNAL ANGLE

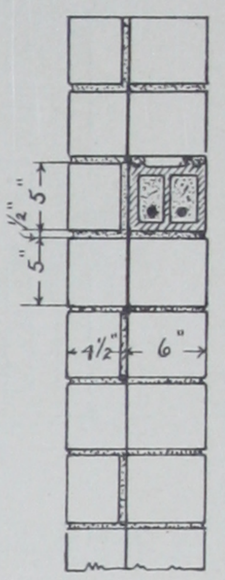
PLAN SHOWING JOIST BEARING

DETAILS OF 6" WALL OF NATCO DOUBLE SHELL TILE

MANUFACTURED AT OHIO AND MIDDLE WESTERN FACTORIES

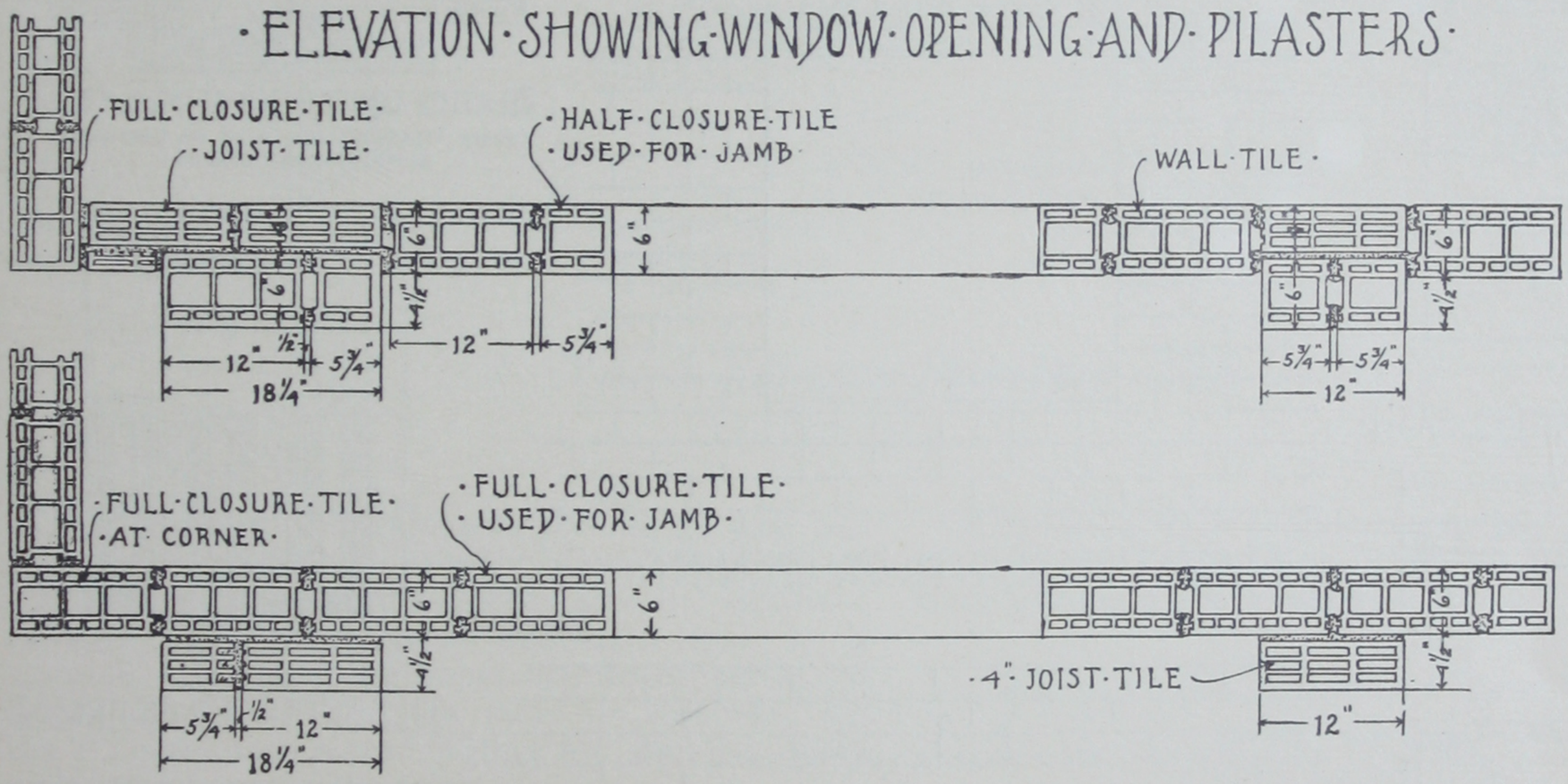
-NOTE- SIMILAR DETAILS FOR PILASTER CONSTRUCTION CAN BE APPLIED TO WALLS 8" THICK



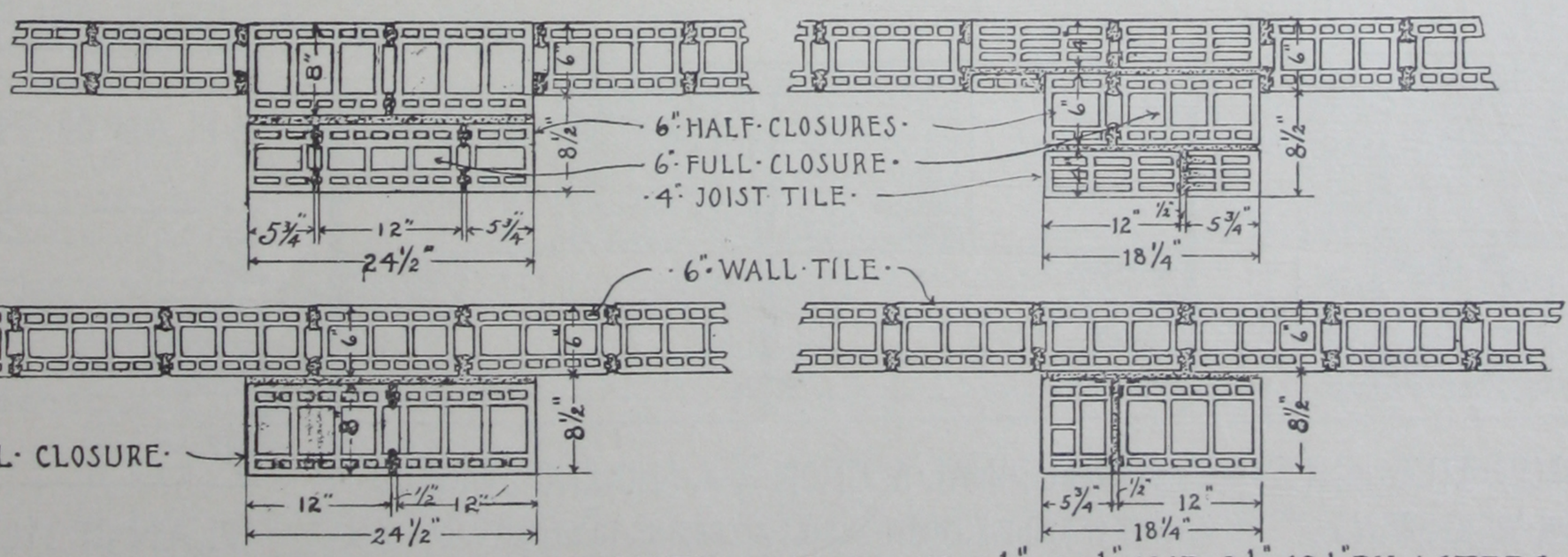


SECTION OF LINTEL

ELEVATION SHOWING WINDOW OPENING AND PILASTERS



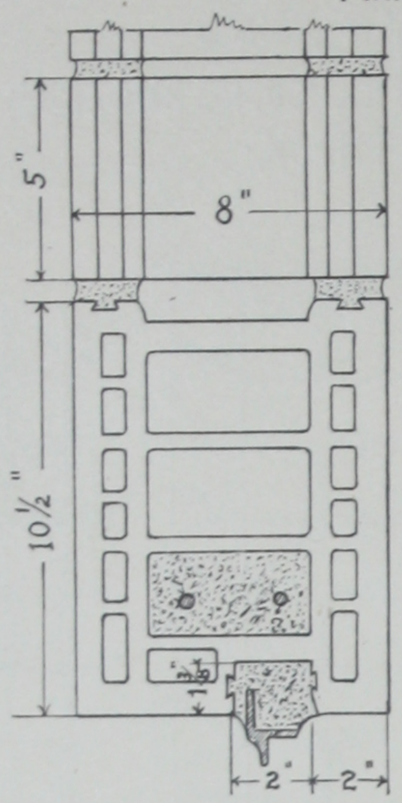
PLANS SHOWING BONDING OF ALTERNATE COURSES OF 4½" x 18¼" AND 4½" x 12" PILASTERS



PLANS SHOWING BONDING OF ALTERNATE COURSES OF 8½" x 24½" AND 8½" x 18¼" PILASTERS

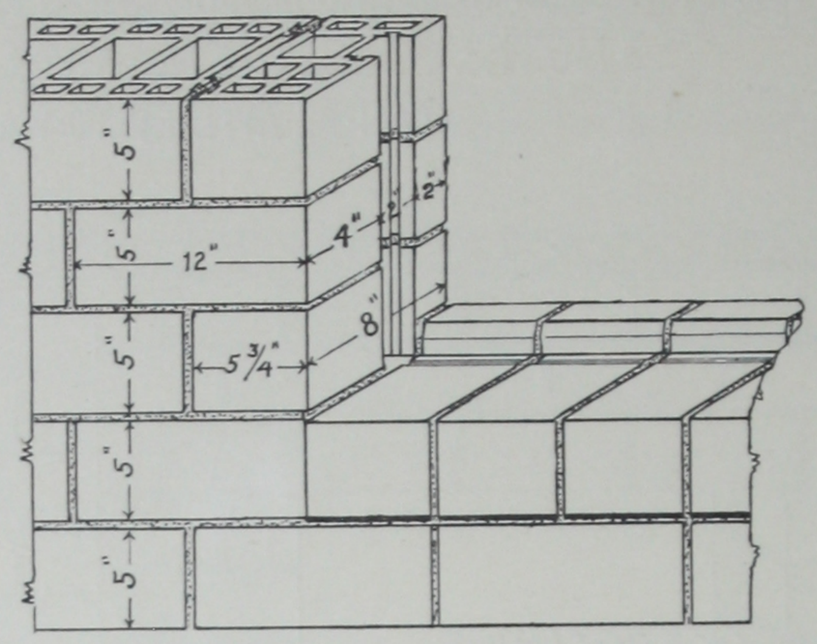
DETAILS OF DOUBLE SHELL TILE FOR STEEL SASH

MANUFACTURED AT OHIO AND MIDDLE-WESTERN FACTORIES

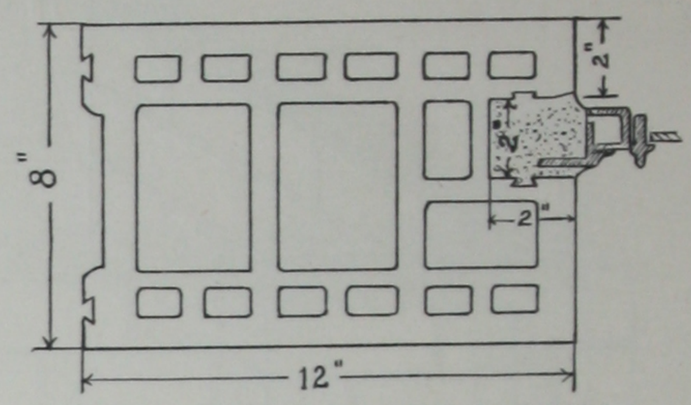


LINTEL TILE FOR STEEL SASH

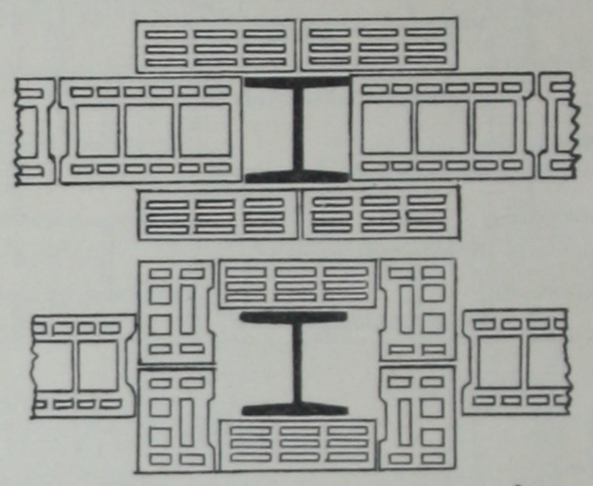
REINFORCEMENT NOT REQUIRED IN SPANS OF LESS THAN 5'-0"



ELEVATION OF JAMB

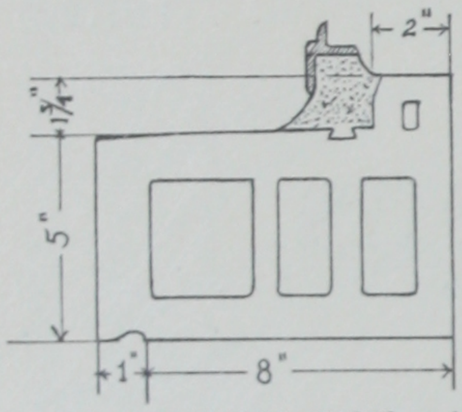


JAMB TILE FOR STEEL SASH

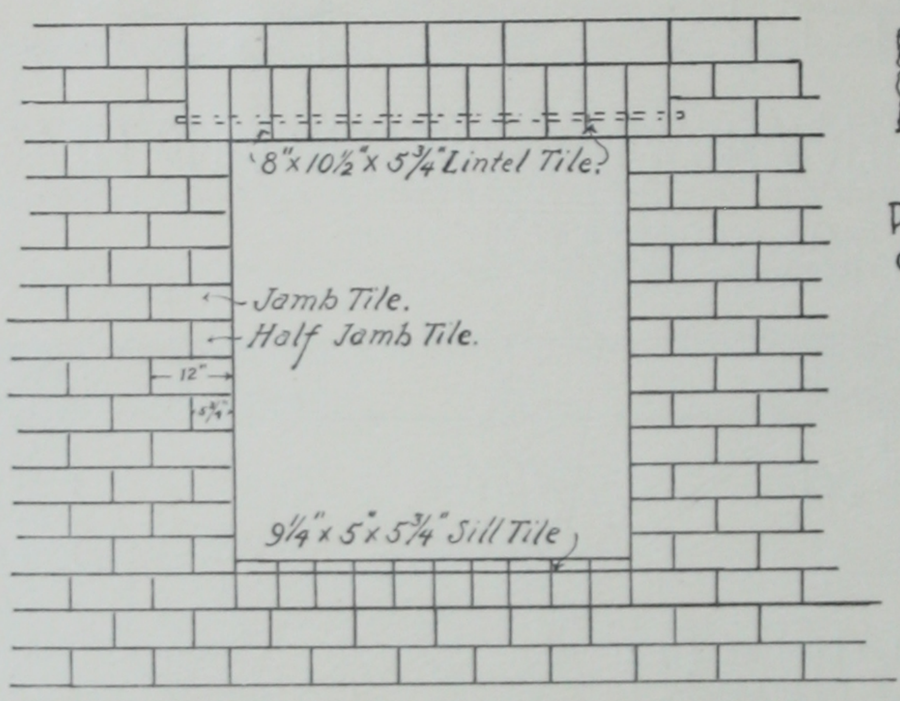


PILASTER CONSTRUCTION AT STEEL COLS.

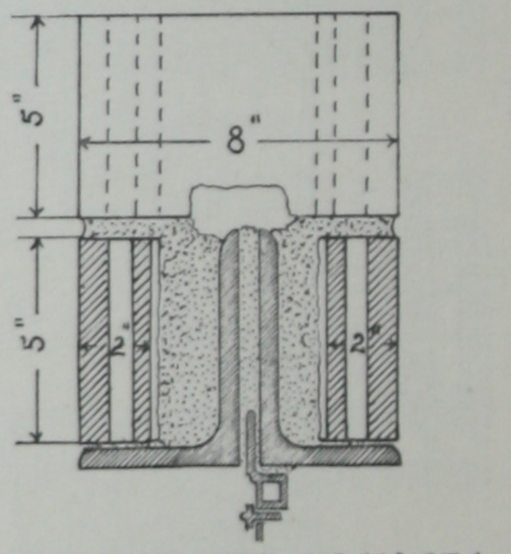
CORNER PILASTERS CAN ALSO BE CONSTRUCTED WITH STANDARD SHAPES



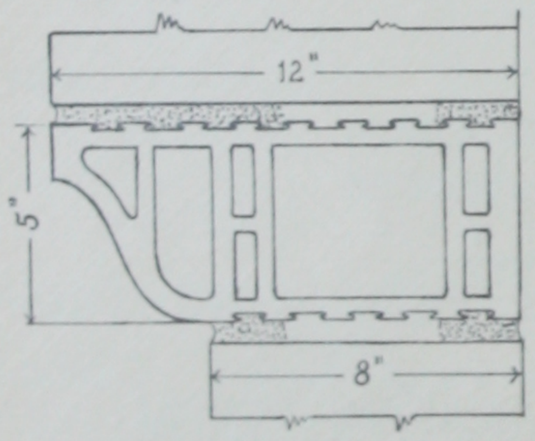
SILL TILE FOR STEEL SASH



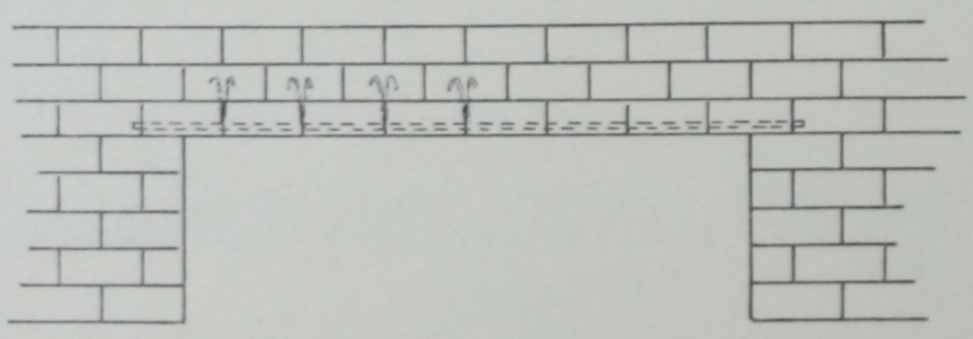
ELEVATION OF WINDOW OPENING



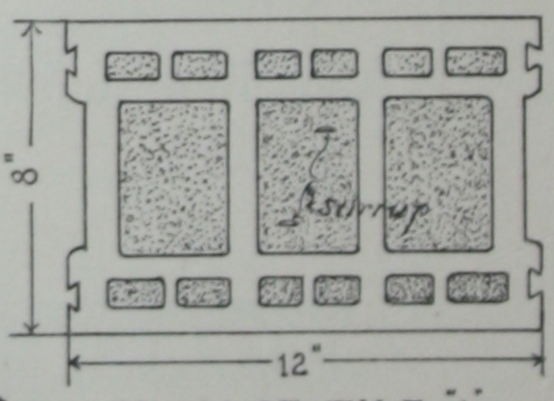
TILE SUPPORTED ON ANGLES



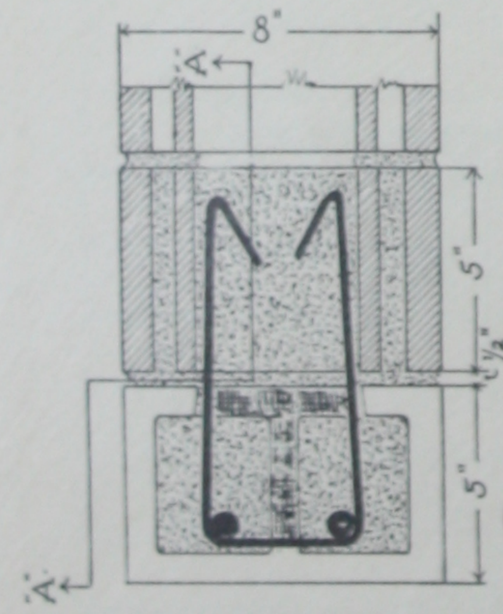
NATCO CORBEL TILE



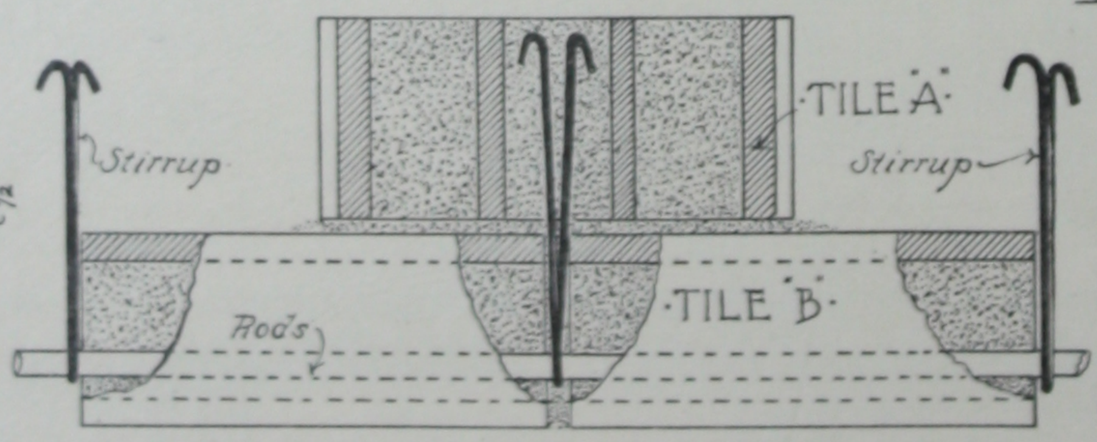
ELEVATION OF LINTEL FOR WIDE OPENINGS



PLAN OF TILE "A"

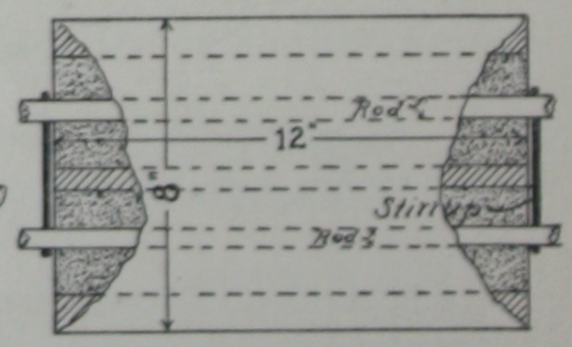


REINFORCED TILE LINTEL FOR WIDE SPANS



LONGITUDINAL SECTION "A"-"A" SHOWING STIRRUPS

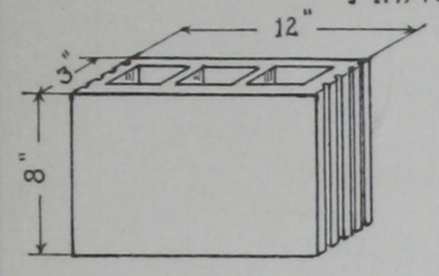
AMOUNT OF REINFORCEMENT VARIES ACCORDING TO WEIGHT AND SPAN
FOR NARROW SPANS STIRRUPS AND CONCRETE FILL IN COURSE "A" ARE OMITTED



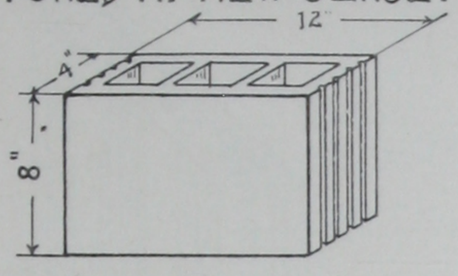
PLAN OF TILE "B"

DETAILS OF SMOOTH BUILDING TILE

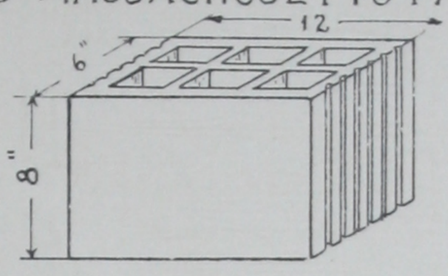
MANUFACTURED AT NEW-JERSEY AND MASSACHUSETTS FACTORIES



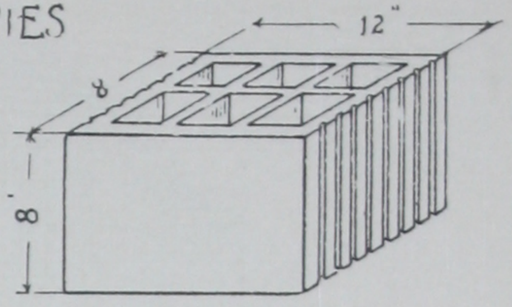
3" WALL TILE



4" WALL TILE

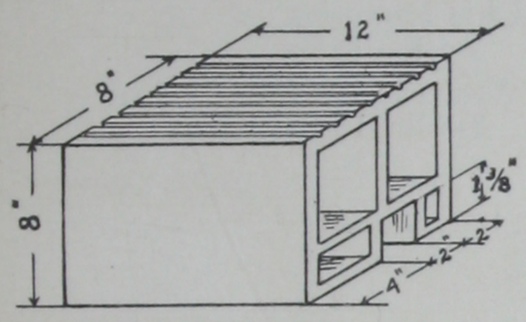


6" WALL TILE

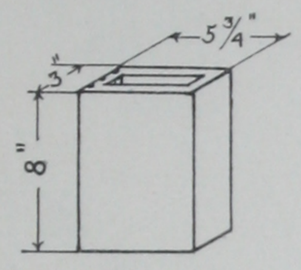


8" WALL TILE

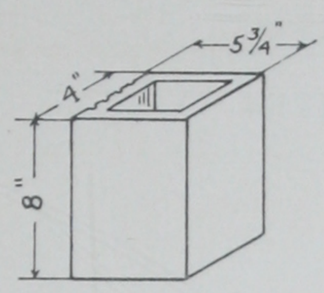
Note:- 3", 4", 6", and 8" Closure Tile same as Wall Tile with one end smooth



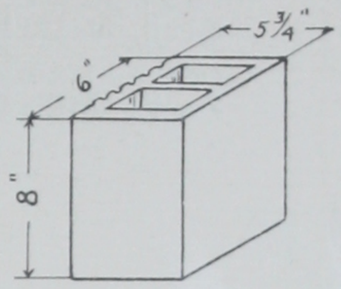
8" LINTEL TILE



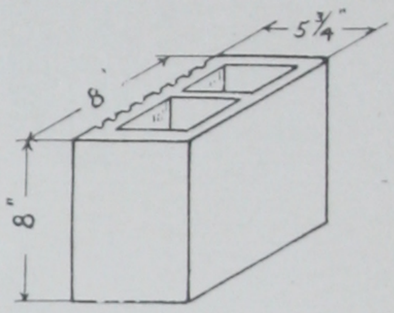
3" HALF CLOSURE



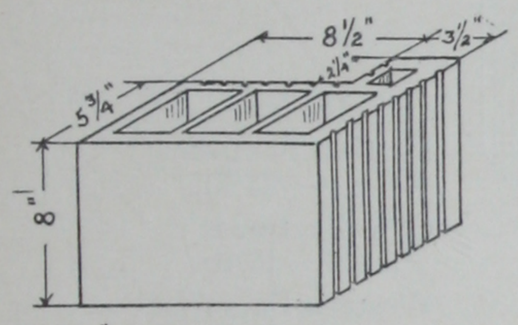
4" HALF CLOSURE



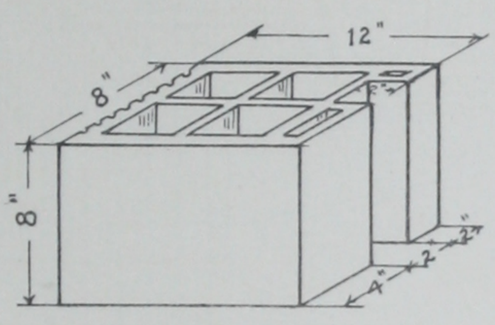
6" HALF CLOSURE



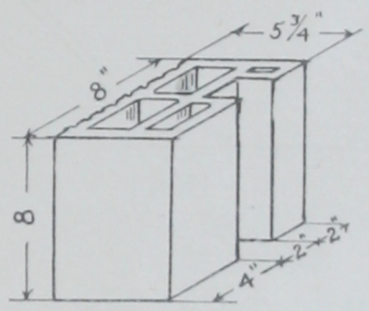
8" HALF CLOSURE



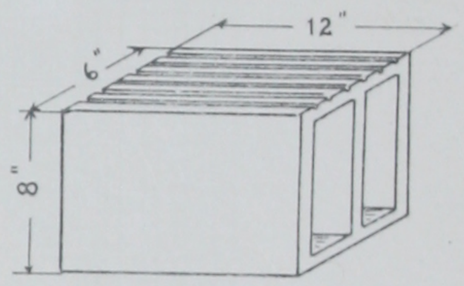
8" CORNER TILE



8" JAMB TILE



8" HALF JAMB



6" LINTEL TILE

Natco Smooth Building Tile

(Illustrated by details above)

This NATCO product was developed and has been used successfully to meet a large demand for a hollow tile unit with a smooth face for factories, railroad warehouses, farm buildings, etc. It is adapted, especially, to panel or curtain walls between reinforced concrete piers or columns. In the 8″ size, jambs and lintels for standard steel sash can be furnished.

For bearing walls, the NATCO XXX design or NATCO Double Shell tile should always be used, however.

The 12″ x 8″ face of this tile is more pleasing to the eye than a 12″ x 12″ face which has been used at times, and is more easily handled and laid than the larger, heavier tile. Also, they are cheaper to lay than the 5″ x 12″ tile (used for the best appearance), and are entirely satisfactory when laid with neatly struck joints and washed down with a weak solution of acid after completion.

Red or black mortar joints add greatly to the appearance of the wall.

1. SIZES—3″ x 12″ x 8″ for walls 3″ thick
4″ x 12″ x 8″ for walls 4″ thick
6″ x 12″ x 8″ for walls 6″ thick
8″ x 12″ x 8″ for walls 8″ thick

When ordered, a proper proportion of half blocks is shipped to break joints. Special shapes to build complete walls are illustrated above.

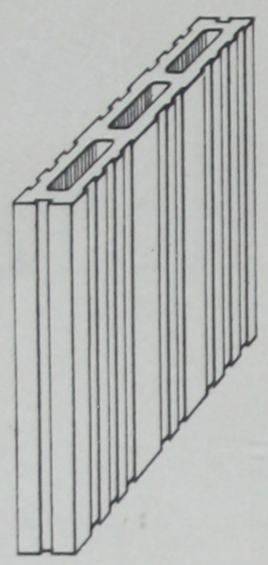
2. TYPES—UNGLAZED. These are of variegated buff color, run of kiln and are for general use. They can be made in light reddish color, one face tex finished and the other face smooth or scored.

GLAZED. These are of a very dark brown or chocolate color and are only used for special purposes, such as to resist acid fumes or where the tile must be impervious to moisture, in which case they should be laid up with waterproof mortar.

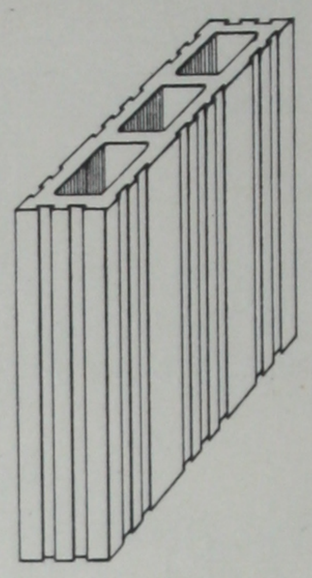
3. In designing height of window and door openings, remember to make these dimensions a multiple of 8½ inches, which allows for ½-inch mortar joints.

4. These tile are principally used in the territory tributary to our eastern factories.

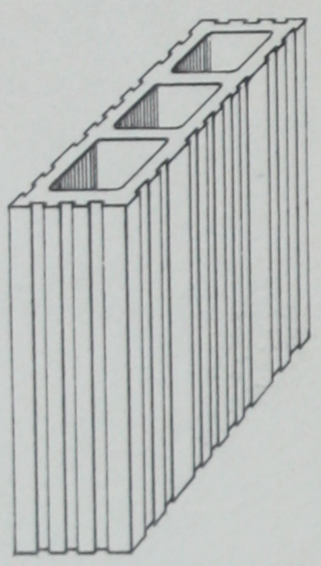
Standard Natco Partition Tile



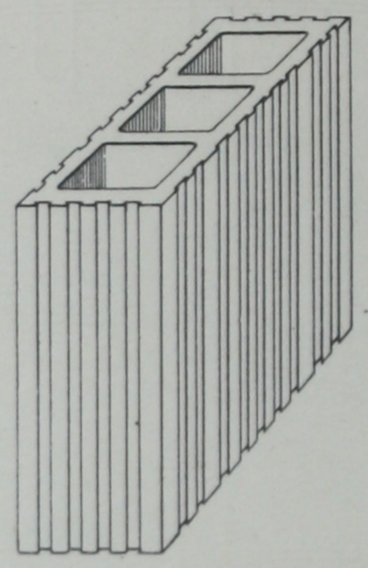
Eastern Factories
2-cell—2x8x12—10 lb.
Ohio Factories
3-cell—2x12x12—15 lb.
Western Factories
3-cell—2x12x12—15 lb.



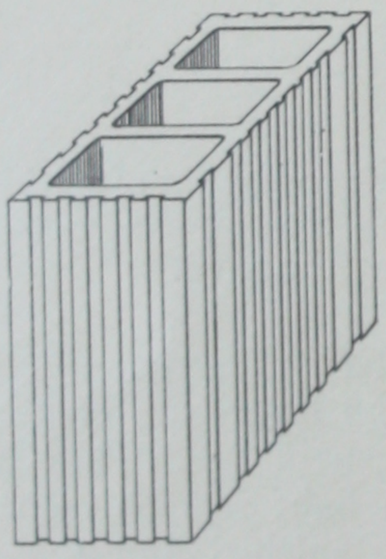
3x12x12
Eastern Factories
3-cell—15 lb.
Ohio Factories
3-cell—15 lb.
Western Factories
3-cell—15 lb.



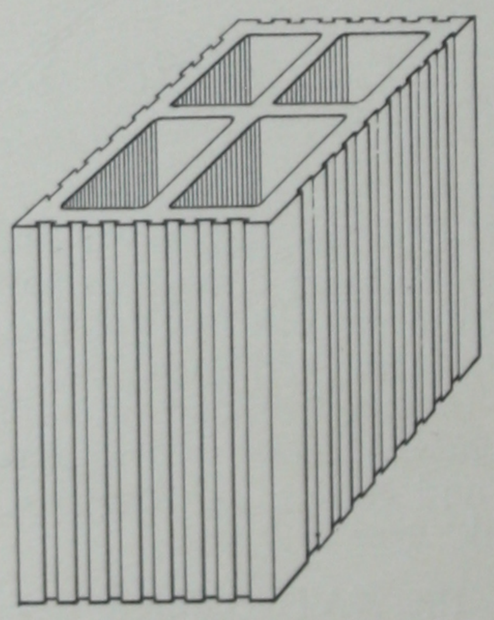
4x12x12
Eastern Factories
3-cell—16 lb.
Ohio Factories
3-cell—16 lb.
Western Factories
3-cell—16 lb.



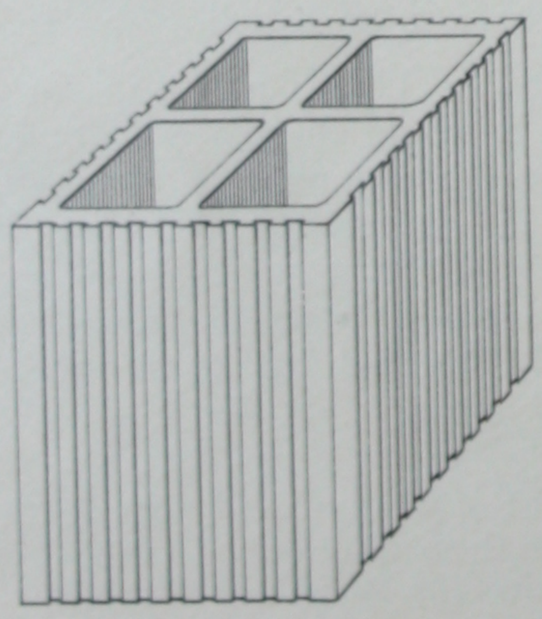
5x12x12
Eastern Factories
6-cell—22 lb.
Ohio Factories
3-cell—19 lb.
Western Factories
3-cell—19 lb.



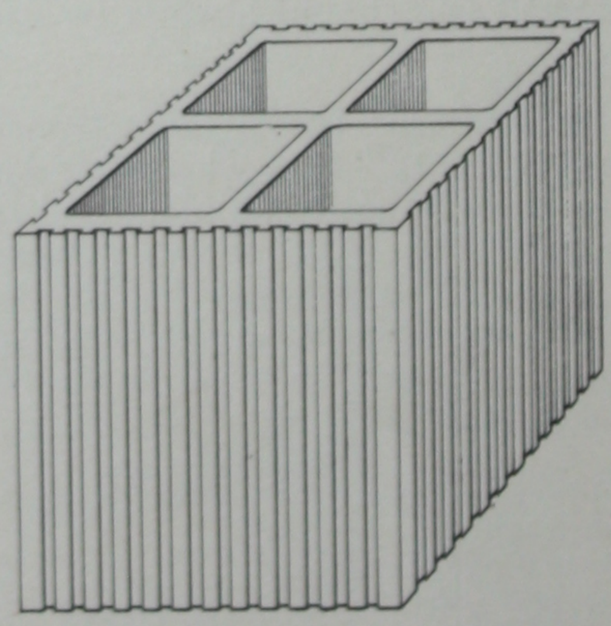
6x12x12
Eastern Factories
6-cell—24 lb.
Ohio Factories
3-cell—22 lb.
Western Factories
3-cell—22 lb.



8x12x12
Eastern Factories
6-cell—30 lb.
Ohio Factories
4-cell—30 lb.
Western Factories
6-cell—30 lb.



10x12x12
Eastern Factories
6-cell—36 lb.
Ohio Factories
4-cell—36 lb.
Western Factories
6-cell—36 lb.



12x12x12
Eastern Factories
6-cell—40 lb.
Ohio Factories
4-cell—40 lb.
Western Factories
6 cell—40 lb.

STANDARD SIZES AND APPROXIMATE WEIGHTS OF PARTITION TILE

Weights given are for estimating purposes and are approximate only

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